INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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The Institute, always confining its attention to the international spect of the various questions concerned, shall:

(*a*) collect, study, and publish as promptly as possible, statistical, echnical, or economic information concerning farming, vegetable and anıal products, trade in agricultural produce, and the prices prevailing in he various markets;

(*b*) communicate the above information as soon as possible to ıose interested;

(*c*) indicate the wages paid for farm work;

(*d*) record new diseases of plants which may appear in any part f the world, showing the regions infected, the progress of the diseases, ıd, if possible, any effective remedies;

(*e*) study questions concerning agricultural co-operation, insurnce, and credit from every point of view; collect and publish information hich might prove of value in the various countries for the organization f agricultural co-operation, insurance and credit;

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

Archine (Russia)	=	27.99961 inches
Ardeb (Egypt)	=	5.44435 bushels
Ardeb of wheat (Egypt)	=	2.95264 cwt.
Ardeb of hulled maize (Egypt)	=	2.75580 cwt.
Ardeb of barley (Egypt)	=	2.36211 cwt.
Ardeb of undecorticated rice (Egypt)	=	5.72812 cwt.
Ardeb of decorticated rice (Egypt)	=	3.83843 cwt.
Arpent (Canada)	=	0.84501 acre
Are [100 square metres]	=	107.63915 square feet
Arroba (Brazil)	=	33.06951 lbs.
Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25.35841 lbs.
Arroba (Mexico)	=	25.36687 lbs.
Bale of cotton (Brazil)	=	396.83415 lbs.
Bale of cotton (United States)	=	4.46431 cwt. (gross wt.)
" " " " "	=	4.26788 cwt. (net wt.)
Bale of cotton (India)	=	3.57145 cwt.
Barrel of wheat flour (Canada, United States)	=	1.75001 cwt.
Bar, see Millier		
Bow (Java, Dutch Indies)	=	76.36998 square feet
Bushel (United States)	=	0.96896 bushels
Bushel of oats (United States)	=	32 lbs.
Bushel of oats (Canada)	=	34 lbs.
Bushel of wheat and potatoes (United States)	=	60 lbs.
Bushel of barley (Canada, United States)	=	48 lbs.
Bushel of raw rice (United States)	=	45 lbs.
Bushel of rye, hulled maize, linseed (Canada, United States)	=	56 lbs.
Cadastral arpent (Hungary)	=	1.42201 acres
Cental (United States)	=	100 lbs.
Centiare [10 square metres]	=	10.76392 square feet
Centigramme	=	0.15432 grains
Centilitre	=	0.0022 gallons
Centimetre	=	0.393715 inches
Centistere	=	0.35315 cubic feet
Centner (Germany, Austria, Denmark)	=	110.23171 lbs.
Centner (Sweden)	=	93.71238 lbs.
Cho [60 ken] (Japan)	=	119.30327 yards.
Cho (Japan)	=	2.45068 acres
Crown [100 heller] (Austria-Hungary)	=	10*d* at par
Crown [100 öre] (Denmark, Norway, Sweden)	=	1s 1 1/9*d* at par
Cubic centimetre	=	0.06102 cubic inch
Cubic metre	=	1.30795 cubic yards
Decagramme [10 grammes]	=	0.35275 oz.

1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Deciare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
1 Decilitre	=	0.022 gallons
	=	0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 $^{33}/_{64}$ *d* at par
1 Dollar, gold, $ [100 cents] (United States)	=	4 *s* 1 $^{5}/_{16}$ *d* at par
1 Drachm, gold [100 lepta] (Greece)	=	9 $^{33}/_{64}$ *d* at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (Egypt)	=	99.04980 lbs.
1 Feddan Masri [24 *Kirat Kamel*] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1 *s* 7 $^{63}/_{64}$ *d* at par
1 Franc [100 centimes] (France)	=	9 $^{33}/_{64}$ *d* at par
1 Gallon (United States)	=	0.83270 gallons
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme [100 grammes]	=	3.52746 oz.
1 Hectolitre [100 litres]	=	21.99755 gallons
	=	2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [100 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold, see Cadastral arpent		
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55014 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69428 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 $^{9}/_{20}$ farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 $^{33}/_{64}$ *d* at par
1 Leu [100 statinki] (Bulgaria)	=	9 $^{33}/_{64}$ *d* at par
1 Lira [100 centesimi] (Italy)	=	9 $^{33}/_{64}$ *d* at par
1 Litre	=	0.21998 gallons
	=	0.0275 bushels
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 $^{3}/_{64}$ *d* at par
1 Mark [100 penni] (Finland)	=	9 $^{33}/_{64}$ *d* at par

1 Maund Factory (India)	=	74.6709 lbs.
1 Maund Imperial (India)	=	82.28136 lbs.
1 Metre	=	3.28084 feet
1 Milliare	=	1.07639 square feet
1 Milligramme	=	0.01543 grains
1 Millilitre	=	0.00022 gallons
1 Millimetre	=	0.03937 inches
1 Millistere	=	61.02361 cubic inches
1 Myriagramme [10 000 grammes]	=	22.04634 lbs.
1 Myrialitre [10 000 litres]	=	2 199.75539 gallons
	=	274.96701 bushels
1 Myriametre [10 000 metres]	=	6.21373 miles
1 Millier [1 000 000 grammes]	=	19.68426 cwt.
1 Milreis, gold (Brazil)	=	2 s 2 $^{61}/_{64}$ d at par
1 Milreis, gold (Portugal)	=	4 s 5 $^{19}/_{64}$ d at par
1 Minot (Canada)	=	1.07306 bushels
1 Morgen (Cape of good Hope)	=	2.11654 acres
1 Muid (Cape of good Hope)	=	24 gallons
	=	3 bushels
1 Oka (Greece)	=	2.75579 lbs.
1 Oke (Egypt)	=	2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain)	=	9 $^{23}/_{64}$ d at par
1 Peso, gold [100 centavos] (Argentina)	=	3 s 11 $^{27}/_{64}$ d at par
1 Peso, gold [100 centavos] (Chili)	=	1 s 5 $^{63}/_{64}$ d at par
1 Pic (Egypt)	=	2.46646 feet
1 Pikul (China)	=	133.27675 lbs.
1 Pikul (Japan)	=	132.27805 lbs.
1 Poud (Russia)	=	36.11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	=	£1. 0. 6 $^{13}/_{64}$ at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	18 s 0 $^{13}/_{64}$ d at par
1 Pund (Sweden)	=	0.93712 lbs.
1 Quintal	=	1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia)	=	2 s 1 $^{3}/_{64}$ d at par
1 Rupee, silver [16 annas] (British India)	=	1 s 4 d at par
1 Square metre	=	1.19599 square yards
1 Stere [1 cubic metre]	=	1.30795 cubic yards
1 Sucre, silver (Ecuador)	=	1 s 11 $^{33}/_{64}$ d at par
1 Talari [20 piastres] (Egypt)	=	4 s 1 $^{17}/_{64}$ d at par
1 To (Japan)	=	0.49601 bushels
	=	3.96815 gallons
1 Ton (metric)	=	0.98421 tons
1 Verst (Russia)	=	1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	=	2 s 0 $^{37}/_{64}$ d at par
1 Zentner (Germany)	=	110.23171 lbs.

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INTERNATIONAL INSTITUTE OF AGRICULTURE
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INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART.

ORIGINAL ARTICLES

The Forest Industry in Sweden

by

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For hundreds of years timber has held an important place among Swedish exports, but it was only towards the middle of the 19th, century that the exportation of this article increased considerably with the demand for sawn timber rather than unhewn timber (spars, etc.) or squared timber (beams, quarters).

In 1913 the values of the woods exported by Sweden were as follows:

Rough hewn timber,	£	1 150 059. 12. 8. 2 *d.*
Sawn, unplaned timber,		7 508 137. 11. 2
Planed and other worked woods (including joinery),		3 11 ; 451. 11. 1
Wood pulp for paper,		5 489 529. 6. 9
Total	£	1 735 2181. 1. 2

This sum represented about $^2/_5$ ths. of the total value of Swedish exports.

The raw materials used in the Swedish saw-mills consist essentially of soft wood — Scotch pine and spruce. About $^3/_5$ ths. pine and a little more than $^2/_5$ ths. spruce are used for making planks, and boards (planed or unplaned). Staves are made chiefly with wood of deciduous trees.

FLOATING THE WOOD. — Although much wood may be carted directly, or sent by rail, from the place where it is felled to the saw-mills, floating is the most important means of transport, and the high place occupied by Sweden in the international timber trade is primarily due to its many

Sweden rise in the high mountains and are sufficiently well fed by the ice and snow for wood to be floated down them throughout the summer. In southern Sweden, on the other hand, it often happens that there is only sufficient water for floating when the rivers are swollen in the spring, or that mills and other works prevent the use of this method. Nevertheless, floating is very common, particularly in the north.

Besides the considerable economy in labour and cost of transport floating has an additional advantage in that wood which has been some months in the water does not warp so easily after sawing as wood sawn immediately after being cut, and has a more uniform colour. On the other hand, the washing of the resin which takes place during floating decreases the life of the wood.

In order that floating may be carried out without hinderance and that the largest quantities of wood may be transported by the water available the water-courses, especially the smallest ones, have been dredged and provided with various constructions such as dikes or sluices to regulate the level of the water in the reservoirs, iron or wooden pipes for guiding the wood in shallow rapids, bars for preventing the wood from catching on the banks, chains for collecting and sorting the wood. For transport on lakes or other smooth water the logs are enclosed, sometimes many thousands at a time, in a frame of large trunks joined together.

These works are carried out by the owner of the forest if he owns both the water used for floating and the wood to be transported, but, as a rule the streams are public transport ways, generally divided by the State, each *being administered by a "Floating Association", which takes charge* of the floating in return for the payment of a tax fixed by the provincial government, the expenses, including the amortization of the cost of installation, being divided amongst the owners of the wood floated. In proportion as this amortization progresses, the cost of floating naturally diminishes. The cost varies considerably according to the amount of water available and the quantity of wood to be floated; on large water-courses it amounts to about 0.124 *d.* to 0.496 *d.* per mile per cubic metre (1), but on small water-courses it is much higher. The total length of the water-courses available for floating in Sweden is estimated at 16 146 miles, of which 14 283 are in the north of the country, above the river Dalälven.

TIMBER SAWING. — Although carried out since the middle ages, the sawing and exportation of timber only developed to a large extent towards the middle of the 19th. century, when a more liberal commercial legislation, the suppression of export dues, and, at the same time, the increasing demand for sawn wood, gave a great impulse to this industry. Its development was also favoured by the abundant water power available. Thus a fairly large number of saw-mills with multiple frames were built in the northern, wooded parts of Sweden ("Norrland"), particularly near waterfalls and the coast. The fact that it was impossible to build these mills actually

(1) 1 cubic metre = 35.317 cubic feet.

on the coast was a drawback, since, in order to ship the sawn wood, it was necessary, either to cart it, tow it to a neighbouring port, which was fairly expensive, or also to float it, which spoilt the appearance and quality of the goods.

In this respect a complete revolution was effected when *steam saw-mills* were built *on the coast*. These gave the following advantages: — abolition of the long and costly transport from the mill to the port; increased capacity of production; better products; abolition of interruptions in the work in water saw-mills caused by freezing in winter and lack of water in summer. The first of these steam mills was built in 1851 at Vifsta, near the town of Sundsvall, and their number increased rapidly.

According to the latest available data, there were in Sweden, in 1913, 1053 industrial saw-mills and machine planing works, without counting a certain number of small mills for home use, worked either by hydraulic or steam power. The total cost of building the former has been estimated at 199 024 488 *crowns* (1 *crown* = 1*s.* 1*d. at par*), thus greatly exceeding the capital required for erecting any other kind of works. The value of the products may be placed at 216 million *crowns*, including the wood and charcoal sold; to this should be added 1 124 684 *crowns*, which represent the value of materials worked.

The number of workmen employed in the industry was 44 150; 1659 frames and 905 planing machines were used. As motive power were used: water-wheels, up to 1040 HP.; water-turbines of 14617 HP.; steam engines of 82 135 HP.; steam turbines of 2 246 HP.; oil and gas engines of 476 HP. Most of this power was used directly for working the machine saws, and the rest (21 949 HP.) for generating electricity for the motors.

The edges and ends of the wood sawn are trimmed with a circular saw, worked either by hand or by electric motor. This only applies to large mills, which have moving platforms worked by electricity for the automatic transport of the wood from the piles to the saws.

Sawn pine wood is often divided into five classes of different qualities, a very delicate operation. On the other hand, most of the spruce wood is shipped without being classed.

Many mills have planing works attached to them, for, in Sweden, planing rarely forms an independent industry, as is usually the case in Norway.

The chief machine saw-mills are those of Mo, Kramfors, Vifsta (the oldest), Skönvik, Bergvik, Korsnäs (or Bomhus) and Skutskär. Kramfors is on the navigable river Angermanälven, along the lower course of which are numerous saw-mills. All the other places follow each other from the north to the south in the order in which they are named, along the coast of the gulf of Bothnia. There is no doubt that the Korsnäs and Skutskär mills, between Gevle and the mouth of the Dalälven, are the largest in Europe. They have 30 and 24 frames respectively, and each ships annually sawn timber wood estimated at 40 000 Petrograd *standards* (1 *standard* = 165 cubic feet for sawn timber).

In northern Sweden (provinces to the north of the Dalälven) there are

of the total production. The northern part of the country has a still greater preponderance in exportation, for, in the more populous southern part, a larger fraction of the products of the mills is sold for home consumption.

In 1913 the total production of the Swedish saw-mills was 6 853 455 cubic metres, distributed as follows :

Unplaned planks and boards	4 693 000 cubic metres
Planed planks	1 210 159
Pieces of planks and boards	358 353
Lenges and laths	99 383
Planks for cases	302 678
Staves	188 892
	6 853 455 cubic metres

In addition to these there are some smaller articles, of which the statistics give the value but not the quantity.

In 1913, 6 877 825 cubic metres of rough, squared and sawn wood were exported. Table I shows the distribution per category and country to which it was exported. During the period 1906-1910, the average amount exported annually was 6 052 000 cubic metres.

Table I shows that the net amount exported in 1913 almost equalled the total production of the mills, but it must be noted that it also includes unhewn wood. In 1914 and 1915 the timber trade was adversely affected on account of the war, and exportation decreased for most kinds of timber. For sawn timber this decrease was about $^1/_5$ th. of the quantity exported in 1913.

TABLE I. — *Quantities of rough, squared and sawn timber exported from Sweden in* 1913 *(in cubic metres).*

Destination	Unplaned planks and boards	Planed planks *	Beams and rafters	Unhewn wood	Wood for mines	Other varieties	*Total*
Norway	121 148	46 541	2 149	124 410	9 179	78 182	381 609
Denmark and Iceland	404 732	87 548	181 558	5 721	1 516	107 593	788 670
United Kingdom	1 117 684	392 133	21 893	19 706	533 547	521 367	2 605 490
Netherlands	247 068	27 371	27 240	17 286	7	39 054	358 026
Germany	584 336	7 219	110 946	49	712	26 191	729 453
France	908 074	341	21 440	754	—	17 992	948 601
Italy	9 761	—	3 481	1 596	—	—	14 838
Other European countries	384 914	6 951	16 445	31	3	29 206	437 550
Egypt	35 238	4 679	53 075	439	—	141	93 572
British Africa	111 420	54 131	—	30	—	1 754	167 335
Australia	19 901	78 598	—	—	—	274	98 773
Other countries	199 114	43 946	9 110	72	999	357	253 598
Total	**4 143 992**	**149 361**	**447 340**	**170 184**	**544 934**	**822 113**	**6 877 825**

* Including boards for packing-cases.

A branch of the timber industry which has recently inspired a certain nervousness, is the exportation of mine props, as it is feared, not without

reason, that this may depopulate the forests. The felling of wood for such props would have no harmful effect if only trees of medium value which might be considered as useless for the rational preservation of the forest, were used ; on the other hand it becomes very serious when, as often happens, whole young plantations are felled.

Mine props are chiefly exported from southern Sweden, which supplies the greater part of the wood used for this purpose ; Norrland (northern Sweden) in particular, also exports a large amount. These props are exported almost exclusively to England.

WOOD PULP AND CELLULOSE INDUSTRY. — This, together with timber-sawing, though a little later, has developed into a flourishing industry, taking 2nd. place as regards value of production. As is well known, wood pulp is divided into two principal varieties according to the method of preparation: 1) *mechanical*, obtained by disintegrating the wood by a runner, under a continuous stream of water ; 2) *chemical*, or wood cellulose, obtained by disintegrating the wood by chemical solutions ; *a*) sodium sulphate (sulphate cellulose) ; *b*) calcium or magnesium bisulphite (bisulphite cellulose). On the other hand, *semi-chemical* wood-pulp is that obtained by first boiling the wood in water, so as to eliminate part of the incrustation, then breaking it up by a mechanical process. This pulp, sometimes called unbleached (brown), is very strong, but, owing to its dark colour, cannot be used for fine paper.

As raw material, spruce is especially used in Sweden (it is used almost exclusively for bisulphate pulp), and also a little pine and aspen wood.

The first mechanical wood-pulp factory was founded in 1857 at Trollhättan. The manufacture of chemical pulp is of more recent date, but has surpassed that of mechanical pulp. The wood-pulp industry, long confined to the south and west of Sweden, has spread greatly, during the last decades, in Norrland and Dalecarlie, where it has been adopted by many large saw-mills in addition to their own principal industry, thus allowing them to utilise small pieces of wood and waste, and to effect the necessary thinning of their forests with greater economic advantage. The development of the cellulose industry has been aided of recent years by a better utilisation of the by-products : alcohol from the waste waters of bisulphite cellulose, oil of turpentine, etc.

It seems that the manufacture of alcohol might be developed ; in 1913, 4 million litres at 50 % were produced, but it has been estimated that the Swedish wood-pulp factories could produce annually 26 million litres of 100 % alcohol.

In 1913 there were in Sweden 167 wood-pulp factories distributed as follows :

Product	No. of factories
Mechanical wood-pulp	83
Mechanical pulp and chemical pulp	17
Chemical sulphate pulp	17
Chemical bisulphite pulp	49
Sulphate pulp and bisulphite pulp	1
	167

The production (expressed in dry matter) was estimated at 1 186 577 tons, of which 326 098 tons were mechanical pulp, 705 099 tons bisulphite pulp and 155 430 tons sulphate pulp. The total value of this production was about 126 million *crowns*.

During the year 1 009 358 tons of paper pulp were exported ; this corresponded to 847 137 tons of dry matter. With the exception of a negligible quantity of rag pulp, this was all wood pulp, divided as follows into the various categories:

Mechanical pulp	moist	261 049 metric tons
	dry	59 198
Bisulphite pulp	bleached	20 690
	unbleached moist	58 548
	» dry	508 134
Sulphate pulp	bleached	10 972
	unbleached moist	1 846
	» dry	85 921
		1 009 358 metric tons

CHARCOAL. — This has been prepared in Sweden since remote times, and has always found regular markets near the place in which it is produced. It is used for iron smelting (blast furnaces and forges), for which it is necessary.

It is prepared by the old pile-method, but also sometimes in ovens, either in metallurgical works or in other places favourably situated for the collection of wood and the forwarding of the charcoal. The manufacture of charcoal on a large scale in piles in the forests is due to the facility with which it may be transported in winter on sledges, thus avoiding the necessity of constructing costly ways of communication. Where it is necessary to transport large quantitites of charcoal to metallurgical works by means of floating, it is best prepared in ovens. Many saw-mills of northern and southern Sweden prepare charcoal with their wood waste, either in piles or in ovens.

Recently the charcoal industry has begun to compete with the wood-pulp industry in the purchase of raw materials. This, together with the rise in wages, has caused a notable rise in the price of charcoal, which has necessitated a restriction of its use by applying various new metallurgical methods, which have succeeded fairly well. Nevertheless, charcoal is still a very important commercial article.

The woods used are spruce and pine. The charring is carried out in either vertical or horizontal piles, so called according to the way in which the wood is piled up. Two parts of wood (loosely piled) give about one part of charcoal. Ovens give a slightly higher yield than piles, but the product is inferior, for it is estimated that 10 parts in volume are required to produce the same amount of heat as nine parts of piled charcoal. On the other hand, charring in ovens gives various by-products; methyl alcohol, acetic acid, essence of turpentine, tar, etc. Specially designed small

ovens are used to collect the tar and oil of turpentine produced during the charring of dry pine stumps.

The following data are available with regard to the production of charcoal in 1913: —

Method of Preparation		Amount of charcoal obtained in bushels
Forest wood charred in ovens		8 063 000
Wood waste	charred in piles	29 166 000
	charred in ovens	1 323 000
		38 552 000

There are no exact statistical data on the quantity of charcoal prepared in piles in the forests, but, according to the following calculation it may be estimated at about 75 502 000 bushels.

Total amount of charcoal used by metallurgic works	117 355 000 bushels
Deduct: Charcoal imported from Finland and Noway	3 301 000
Total amount of charcoal produced in Sweden	114 054 000
Deduct: Production of charcoal known from statistics	38 552 000
Amount of charcoal prepared in piles in the forests	75 502 000

PRODUCTS FROM THE DRY DISTILLATION OF WOOD. — Formerly the preparation of wood tar was an important industry in Sweden as it was one of the principal exports. At the present day this industry is carried out only in the two most northern provinces, and the tar produced is exported chiefly from the town of Umea. For its manufcture large funnel-shaped utensils, open at the top, are used. The wood is piled up in them and covered with earth ; the tar runs out from underneath. Various saw-mills have tar ovens from which are obtained, not only tar, but also the other products of dry distillation: methyl alcohol, acetic acid, acetone, etc.

Table II gives the data concerning the importation and exportation of these various products in 1913.

TABLE II. — *Importation and exportation of the products and by-products of the dry distillation of wood, in* 1913.

Products	Importation		Exportation	
	Quantity (metric tons)	Value	Quantity (metric tons)	Value
		£		£
Tar and its residues	330	2 036 11. 0	7 696	52 841 15. 8
Black pitch	3 950	21 784 13. 1	130	016 4.10
Resin	7 077	108 127 0.11	9	143 2. 5
Resin gum	90	2 478 5. 0	862	22 097 12. 0
Oil of turpentine	516	10 180 16. 8	228	5 756 17. 2
Methyl alcohol	0.7	23 19. 0	401	11 279 5. 4
Acetone	62	1 015 15. 0	150	7 739 8. 2

The important place occupied in Swedish imports by that of wood of various kinds has already been pointed out. A comparison of the wood exports of Sweden and other countries is difficult, as are all international statistics on account of the different methods of calculation in use in the various countries. Nevertheless, the data contained in Table III, taken from the official statistics of each country, shows fairly well the place held by each of the principal wood-exporting countries.

TABLE III. — *Wood exports of the principal exporting countries from* 1906 *to* 1913.

Country	1908	1909	1910	Average annual value from 1906 to 1910	1911	1912	1913
	$	£	£	£	£	£	£
Sweden	11 976 763	11 718 494	14 578 705	12 951 572	15 096 513	16 595 060	18 256 0[illegible]
Norway.	1 429 018	4 048 463	4 377 509	4 294 255	4 297 885	4 678 999	4 955 0[illegible]
Finland	5 535 380	5 948 305	6 887 121	6 111 312	7 236 679	5 062 6[illegible]	[illegible]
Russia	11 733 914	13 318 467	14 551 935	12 269 442	14 712 254	16 122 168	17 290 8[illegible]
Austria-Hungary . . .	12 865 871	12 466 260	13 535 578	13 559 130	12 731 600	14 468 912	13 531 85[illegible]
United States *	16 746 043	13 940 433	16 188 849	15 636 967	18 952 392	21 863 398	23 930 7[illegible]
Canada *	9 173 434	10 994 502	10 682 902	10 270 158	9 634 111	10 192 763	10 268 6[illegible]

* In these two countries the commercial years do not coincide with the solar years.

The high figures of the United States timber exports may probably be explained partly by the fact that they also include valuable wood (oak and other deciduous trees).

The exporting countries have only been compared with regard to the *value* of their exports, as it is not possible to make an exact comparison of the *amount of wood* exported. All that can be said on this point is that, in Europe, the first place has been held alternately by Russia (without Finland) and Austria-Hungary, then during the last two or three years, by Sweden.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

: – **International Yearbook of Agricultural Legislation, 7th. Year (1916).** – INTERNATIONAL INSTITUTE OF AGRICULTURE, Rome 1917.

The seventh volume of the *International Yearbook of Agricultural Legislation* has just been published by the International Institute of Agriculture. It contains, systematically classified, all the laws relating to agriculture in the various countries. This publication is, therefore, of great interest under the present war conditions.

The *Yearbook* is divided into 11 parts : – The first (Statistics), second (Commerce), fourth (Industries depending on plant products), and fifth (Industries depending on animal products) are of the greatest interest to those who wish to follow, in all its details, the legislative movement with regard to foodstuffs brought about by the European crisis. In these divisions of the *Yearbook* is included everything bearing on : Statistics of stocks and crops ; trade in cereals and supplies in general ; trade in other vegetable foodstuffs ; seed trade ; fertiliser trade ; trade in oil-yielding fruits ; trade in textile plants and tobacco ; trade in live stock and animal products ; trade in agricultural machinery ; facilities granted for imports and restrictions laid on exports ; measures for forestalling and dealing with the rise in prices ; dishonest competition and fraud in trade ; legal measures for regulating commercial contracts ; measures for preventing the advance sale of crops ; transport of vegetable and animal products ; regulation of industries concerning plant products and chemical fertilisers ; regulation of crops during the war.

The 7th. part, devoted to plant diseases, weeds and animals injurious to agriculture, gives the text of the Egyptian laws concerning : the protection of plants against diseases from abroad, diseases of fruit trees, the de-

struction of the cotton bollworm, orange pest (*Aspidiotus aonidum*), the text of the Soudan order concerning the destruction of locusts. It also includes : the orders of the French Government with regard to the sale and use in agriculture of arsenical compounds ; an Australian (Victoria) law concerning the sale of anti-cryptogamic products and insecticides ; the order for carrying out the Italian law of June 26th., 1913, No. 881, on plant diseases ; the various Italian decrees for the control of field mice.

The *Yearbook* contains many provisions with regard to agricultural co-operation, insurance and credit.

The part devoted to rural property includes the strictly legal measures defining and regulating the rights of property, and the charges on real estate held either in usufruct or by way of security ; the provisions to be observed in the transmission of these rights and in the determination of the title to ownership, especially in the interest of third parties ; the method of precedure with regard to attachments on movable goods and real estate. It also contains the provisions of a more specially social and political nature, which tend to act directly on the distribution of real estate and to allow a more complete use being made of the land.

With regard to the less important measures the *Yearbook* only gives the original title together with the French translation ; for the others, either extracts from the text or else the whole text is given. There is an analytical introduction of 77 pages published in five languages, French, English, Italian, Spanish and German, which gives a summary of the whole volume (1250 pages). There is also a chronological index of the countries and an alphabetical subject index.

2 - **A Biological Analysis of Pellagra-Producing Diets : I) The Dietary Properties of Mixtures of Maize Kernel and Beans.** — Mc COLLUM, E. V. and SIMMONDS, N., in the *Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 29-61, 24 charts. Baltimore, Md., October, 1917.

The first phase of the studies on nutrition undertaken by the authors and their collaborators at the Laboratory of Agricultural Chemistry of the University of Wisconsin, Madison (1), dealt with the cause of nutritive failure in animals restricted to diets of proteins, carbohydrates, fats and inorganic salts, all the foods being chemically pure. After a careful consideration of the work of HOPKINS, STEPP, and FUNK, the authors came to the conclusion that these mixtures were lacking in two substances, or groups of substances, indispensable to the preservation of animal life.

(1) HART, E. B., Mc COLLUM, E. V., STEENBOCK, H. and HUMPHREY, G. C., *Wisconsin Agricultural Experiment Station, Research Bulletin* 17, 1911 ; HART and Mc COLLUM, *Journal of Biological Chemistry*, 1914, Vol. XIX, p. 373 ; Mc COLLUM and DAVIS, *Ibid.*, 1915, Vol. XX, p. 115. Vol. XXIII, pp. 181 and 231 ; Mc COLLUM, SIMMONDS and PITZ, *American Journal of Physiology*, 1916, Vol. XII, pp. 333 and 361 ; Mc COLLUM and KENNEDY, *Journal of Biological Chemistry*, 1916, Vol. XXIV, p. 491 ; Mc COLLUM, SIMMONDS and PITZ, *Ibid.*, 1916, Vol. XXV, p. 105 ; HART, MILLER and Mc COLLUM, *Ibid.*, 1916, Vol. XXV, p. 230 ; Mc COLLUM, SIMMONDS and PITZ, *Ibid.*, 1916-1917, Vol. XXVII, pp. 153 and 211 ; Mc COLLUM, *Journal of the American Medical Association*, 1917, Vol. LXVIII, p. 1379 ; Mc COLLUM, SIMMONDS and PITZ, *Journal of Biological Chemistry*, 1917, Vol. XXIX, pp. 341 and 521 ; Vol. XXX, p. 13 ; Mc COLLUM and PITZ, *Ibid.*, 1917, Vol. XXXI, p. 229. (*Ed.*)

One of these (fat-soluble A), is soluble in fats, and found in its most concentrated form in butter fat and egg yolk fats. The second substance is never associated with fats in foods, but is always present in natural foods in relative abundance. It is easily administered in experimental rations by the addition of alcoholic extracts of natural foods, but it is also soluble in water. This is called by the authors water-soluble B.

The authors showed phosphorised proteins to have no superior value to those containing no phosphorus and it is now known that a long list of substances (including complex lipoids, pigments, sulphatides of the nerve tissues, components of the various prosthetic groups) with which the body proteins are combined, are produced within the tissues and do not need to be supplied with the food. The synthetic capacity of the animal cells has thus been shown to be immeasurably greater than had been supposed, but all the evidence still points to the fact that nearly all the amino-acids formed during the digestion of proteins are indispensable components of the diet. Moreover, the animal tissues are very dependent upon certain of the finer stereochemical structures in both the amino-acid and carbohydrate groups which serve them as food complexes.

The second part of the studies was an examination, one by one, of several typical representatives of the classes of natural food substances, such as the seeds, leaves, fruits and tubers of plants. The exact nature of the additions of the factors A and B necessary to complete one of these food substances from the nutrition standpoint was shown. Some of these studies are still in progress.

The results show that serious errors may be made in the choice of foods, especially by the poor. Beri-beri, scurvy, rickets and pellagra, have all been proved to be due to defective diet, although different opinions still prevail as to the etiology of the last disease. FUNK attributed each of the above-mentioned syndromes to the absence of a specific chemical substance which he called "vitamine". The work of the authors and their collaborators on the nature of the dietary deficiencies of any natural foodstuffs has lead them to conclude that, under the present existing conditions, there are three other dietary factors causing malnutrition in both man and animals.

The third part of the studies, described in the present papers, consisted in a close experimental enquiry into the properties, with regard to the several dietary factors, of the diets usual in human nutrition and derived from all the more important food materials (except milk and eggs) in common use in the United States. Eggs, and more particularly milk, are a wonderful safeguard in human nutrition, and a valuable addition to all rations used in animal production.

In a previous paper were discussed the points of resemblance in the dietary properties of seeds in general as contrasted with those of the leaf of the plant. The most important generalisations which can be made concerning the seeds as a group are the following: —

1) None of the seeds studied, when forming the sole source of nutriment, can produce growth or prolonged well-being in a young animal. Mixtures of seeds are more satisfactory

for keeping animals in a good state of health, without growth, than seeds of a single species as a sole food ; mixtures of seeds fed with distilled water (salt-free) will not support growth in young rats.

2) The inorganic content of each of the seeds studied (wheat, oat, maize, rice, wheat germ, bean, pea, flax and millet) is so constituted with respect to the total quantity and relative quantities of its constituents that certain salt additions are essential before growth can proceed in young animals. This applies both to mixtures of seeds and to seeds of a single variety.

3) The seeds of wheat, oat, maize, rice, bean and pea are too low in their content of a dietary essential, the nature of which is still unknown, to supply the needs of a young animal during growth. This substance is present in abundance in certain fats, such as butter and egg yolk fats, and the fats extracted by solvents from animal organs, such as the liver and kidney, free from visible fats. It is also found in abundance in the leaves of plants and in considerable quantities in the seeds of flax and millet. The authors have provisionally called this dietary essential "fat-soluble A". It is not extracted from plants with the fats by solvents such as ether, chloroform, benzene or acetone, and is, therefore, not found in any fats or oils of plant origin. Hot alcohol does not remove it from plant tissues.

4) All the seeds studied contain protein mixtures of a relatively poor quantity when the proteins of a single kind of seed serve as the sole source of proteins.

5) Each of the seeds studied can be supplemented by highly purified protein, pure inorganic salts, and one of the growth promoting fats, so as to form a satisfactory ration for growth and maintenance. 15 to 20 % of any one of the seeds mentioned, when fed with a mixture of purified food substances, will serve to supply all unidentified dietary factors soluble in water or alcohol. So far there is evidence of only one such indispensable substance — water soluble B — which is never associated with fats of either animal or plant origin.

6) Generalising from studies of three types, clover, alfalfa and cabbage, the leaf differs from the seed in having a high content of inorganic elements, and is particularly rich in those elements, calcium, sodium and chlorine, which are found in but small amounts in the seed. The leaf is much richer in the fat-soluble A than are such seeds as wheat, oat, maize, bean and pea. Leaf and seed supplement each other with respect to these two dietary factors. Since, in many cases at least, the leaf and seed mixtures have been shown to yield adequate protein mixtures there is probably always some supplementary relationship between them with respect to the amounts of the various amino-acids which they yield on digestion.

In the studies quoted no systematic data were given showing the dietary properties of mixtures of cereal and legume seeds. The present paper describes the nature of the purified food additions which must be made to combinations of the maize kernel and the white (navy) bean in various proportions in order to make these seed mixtures dietetically complete. The experiments described aimed at making clear the value of each dietary factor in the maize bean mixtures as compared with several of the most important seeds, especially maize, wheat and navy bean. These last were thoroughly studied separately so as to show the nature of their dietary deficiencies.

The results, obtained with rats, are given in a set of charts and summarised as follows : —

1) The two seeds mixed, as when separate, contain too small an amount of fat-soluble A to induce optimum well-being in growing animals.

2) The mixtures of maize and beans furnish a great abundance of the second unidentified dietary factor, water soluble B.

3) The most satisfactory protein mixture obtainable with these two seeds consists in about 80 % of maize and 20 % of bean. This protein mixture has a slightly higher biological value than an equivalent amount of maize kernel proteins. In smaller quantities (*e. g.* 7 % of the food mixture) the proteins of the wheat and the maize kernel have about the same value. When a ration is properly constituted with regard to other factors and contains 9 % of wheat proteins, growth may be practically normal over a period of 5 months, after which an injurious effect is apparent in stunting and lack of fertility. It is highly probable that if the maize protein content were raised to 12 % approximately normal growth would result. Better results are obtained by adding pure casein to a ration composed of a mixture of 12 % of maize (63 % of the mixture) and beans (37 % of the mixture).

In a previous paper the authors showed that 6 % of milk proteins in a food mixture just suffice to support normal growth in rats. The protein mixture from 80 % maize and 20 % beans has, therefore, just about one-half the biological value for growth that the total protein mixture in milk possesses.

4) A detailed study was made of the exact nature of the mineral deficiencies of the maize and bean mixtures. The results confirm others previously obtained in which sodium and calcium were shown to be the elements determining the unsatisfactory character of the mineral content of seeds in general. This is of great importance in human nutrition and agricultural practice in districts where the drinking water is nearly free from lime and sodium chloride. Efficient utilisation of food by growing animals is not possible when the diet is deficient in these elements.

As regards human nutrition in districts where the water is low in calcium and sodium the ration may be completed by milk or leaves of plants. The use of leaves in almost strictly vegetarian diets maintains life, as they supply the mineral deficiencies and the shortage of the fat-soluble A in the seeds.

The investigations carried out by the authors by special methods, show how near the danger line is the faulty diet of some classes of people, even in the United States. GOLDBERGER (*Journal of the American Medical Association*, 1916, Vol. LXVI, p. 471) obtained experimental pellagra with a diet typical of that eaten by pellagrins — wheat flour (patent), corn meal, corn grits, corn starch, white polished rice, standard granulated sugar, cane sugar, sweet potatoes, pork fat (fried out of salt pork), cabbage, collards, turnip greens and coffee. Calculated on a wet basis, the sweet potatoes, cabbage and collards made $^1/_5$ th. of the diet, but, on a dry basis, only 4 % of the total solids. This quantity is insufficient to make good the serious shortage of calcium and sodium in the remainder of the diet. Sodium is supplied by the salt added, but there is still a deficiency of calcium. The work of the authors shows that there is far from an adequate quantity of the fat-soluble A in GOLDBERGER's diet, the protein content of which was not above 8 % of the food mixture. In an experiment carried out by the authors a diet containing 12.5 % of protein, supplied by 63 % of maize kernel and 37 % of beans, was insufficient for rats. As the animals developed normally immediately casein was added to their diet, the deficiency of the diet can only be attributed to shortage of proteins. In the light of such experimental evidence it is entirely unnecessary to attribute the cause of pellagra to the absence of a hypothetical "vitamine".

3 - **War Bread (Unsalted Lime Bread).** — DUBOIS, RAPHAEL, in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 17, pp. 818-821. Paris, November, 1917.

The French nation eats bread containing from 15 to 20 grms. of salt per kg. In Paris the proportion is sometimes as high as 22, and even 25 grms. Those eating 1 kg. of bread, therefore, consume an average of 20 grms. of salt in the bread alone. The amount of salt mixed with other foods may, on an average, be placed at 10 grms. Finally, according to GAUDE (*Cours de Minéralogie*, 1st. Series, 2nd. Ed., pp. 65-66) the amount of salt contained *naturally* in the food eaten is not less than 20 grms. a day.

These facts show that, on an average, an adult person consumes 50 grms. of salt daily. The figure seems excessive, since the amount of salt excreted daily, without decomposition, is estimated at from 18 to 20 grms. only. This would mean that 30 grms. of salt remain to supply the hydrochloric acid of the gastric juice, which seems hardly admissible, even for hyperhydrochloric subjects. It is true that vegetarians require a larger quantity of salt, since, according to BUNGE, it helps to remove the potassium, contained in large quantities in vegetables, but, in proportion to people living on a mixed diet, there is but a small number of vegetarians.

An excess of salt in seasoning causes the assimilation of the food to be destroyed to too great an extent, and this can only be compensated for by an increased consumption. The author's experiments show that the amount of unsalted bread eaten is less by one quarter than that of salted bread. The same would probably apply to other foodstuffs, a very important fact from an economic point of view. Moreover, an excessive consumption of solid foods is accompanied by an excessive consumption of liquids, and, among those using alcoholic drinks, the salt becomes accessory to the alcohol.

In view of the great benefit derived in therapeutics by the *elimination of chlorides* in many cases of arthritis, it is probable that the *preventative* partial elimination of chlorides by the use of unsalted bread would be advantageous.

There is no danger that the insipid taste of unsalted bread would prevent its being eaten by the public. In certain countries, for example in some of the districts of Italy, Tuscany in particular, salt is not added to the bread. Many people prefer it to salted bread; others soon get accustomed to it.

The author recommends a bread which he calls *unsalted lime bread*, because, to every kg. of bread, are added from 15 to 20 grms. of calcium carbonate, which, unlike lime water, does not "kill the yeast" by preventing the dough from rising. Washed chalk or precipitated calcium carbonate answer the purpose equally well, but the author prefers prepared chalk. The chalk is mixed with water, and with it is made the dough, which gains in whiteness, rises perfectly, is never acid, and has a very appetising smell. The excess of calcium carbonate has no ill effects, as the author proved by eating large quantities of it.

The author does not believe the idea of adding chalk to bread to be new, but has been unable to find any published reference to it.

4 – **The Nutritive Value of the Soy Bean.** – DANIELS, AMY, L. and NICHOLLS, NELL, B., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 91-102, 6 diagrams. Baltimore, October, 1917.

This paper gives an account of work carried out at the Department of Home Economics, University of Wisconsin, Madison. In order to determine the nutritive efficiency of a given food, it is necessary to make biological tests, as well as chemical determinations, for chemical analysis does not determine the optimum amounts of the various amino-acids necessary to physiological well-being nor the chemical nature of the food accessories.

In the biological experiment made by the writers, the soy bean was fed to rats. In a preliminary investigation, it was found that when these animals were give exclusively soy beans, they failed to grow. When, however, the rats were placed on a ration consisting of : soy beans (60 per cent.), lard (16 per cent.), maize starch (18.7 per cent.) and a salt mixture (6.3 per cent.), containing calcium, chlorine and sodium, the animals grew and reproduced, but the adult rats were under-sized, and the younger were not only smaller at birth, but the litters were also smaller. The addition of the salt mixture, therefore, did not produce a perfect food. The fact that 2 generations of rats were reared on this ration, shows that the soy bean must contain an abundance of MAC COLLUMS's " fat-soluble A " which, on the contrary, is only present in small quantities in certain cereal seeds. This was also confirmed by the difference in the development of several rats fed upon a diet of purified food substances (freed from fat-soluble A) and the growth of four animals of the same litter which were fed a ration of 50 per cent. soy bean without any addition of fat. In this connection, it is interesting to note that Mac Collum found that the extracted oil of soy bean was quite free from " fat-soluble A ".

Young animals produced and suckled by mothers having a liberal supply of " fat-soluble A " were able to withstand a shortage of this material during their most rapidly-growing period much better than those animals whose mothers received considerably less. A plausible explanation for this marked difference in the behaviour of the 2 groups seems to be, that a diet suitable for the maintenance of adult animals, and for reproduction, does not contain a sufficient amount of fat-soluble A to insure the growth of young animals. The writers conclude from these 2 facts : 1) animals can accumulate a reserve of fat-soluble A ; 2) young animals require a greater amount of this substance than adult ones.

In all the experiments, the value of the protein of the soy bean has been demonstrated, and it appears to be quite equal to that of the casein of milk. These findings are somewhat surprising in view of the fact that the protein of other legumes (peas and white beans) has been found insufficient.

A diet lacking " water-soluble B " retards growth and produces abnormal physiological conditions such as beri-beri and polyneuritis.

In the dietary used in these experiments by the writers the soy bean was the only possible source of " water soluble B ". Since none of the rats in this investigation presented any of these symptoms, it is logical to conclude that soy beans are rich in this water-soluble substance.

An economic consideration of the soy bean leads us to conclude that it is one of the most valuable of leguminous seeds for human consumption, for it contains a high percentage (36.5 per cent.) of physiologically good protein, a considerable amount of energy-yielding material in the form of fat (17.5 per cent.) and carbohydrate (12 per cent. digestible), and a large amount of " water soluble A " and " water-soluble B ", which substances promote growth.

5 - **Recent Investigations and Observations Made at the Imperial Institute (London)** (1). — *Bulletin of the Imperial Institute*, Vol. XV, No. 1, pp. 1-46; 78-82; 107-11. London, January-March, 1917.

THE PRODUCTION OF WHEAT AND OTHER CEREALS IN EGYPT. — More than $^4/_5$ of the total area cultivated in Egypt (in round numbers 5 350 000 *feddans*, or Egyptian acres = 5 553 300 English acres), is capable of growing wheat, but so long as cotton remains as remunerative a crop as it is at present, there is very little chance of an increase in the area at present assigned to wheat.

Indeed with the abnormally high prices which now rule for cotton, it is probable that the area occupied by that crop will exceed the percentage of 32.5, which has been the proportion of the cultivated land occupied by it during the last few years. The restriction of the cotton areas during 1915 and 1916 allowed a slight increase in the area sown in wheat and a few other cereal crops, but the increase must be looked upon as abnormal, and the extent usually given to that crop may be considered to be 1 300 000 feddans (1 349 400 acres) Taking the cultivated land roughly at 5 350 000 feddans (5 553 300 acres), this represents 24.3 per cent of the whole.

The most important cereals grown in Egypt in addition to wheat are maize, rice and millet (barley occupies 7-8 per cent. of the cultivated area, but it is almost entirely used for cattle food). As is shown by Table I, the country is unable to grow sufficient cereals for its own consumption (including the amount required for seed) in normal years. No new lands are likely to become available for wheat planting in the near future, but much remains to be done in improving the wheat strains, the methods of marketing, and the system of cultivation.

TABLE I. — *Production and Consumption (in metric tons) of Wheat, Maize, Rice and Millet in Egypt During the Period* 1910-1915.

	1910-1911	1911-1912	1912-1913	1913-1914	1914-1915
Production . .	2 944 509	2 886 900	2 929 513	2 891 115	3 000 85
Consumption .	3 128 561	3 096 220	3 231 948	3 030 572	3 039 3
Difference .	— 183 971	— 209 320	— 302 435	— 139 547	+ 27 17

(1) See also, *B.* 1915, No. 5; *R.* 1917, No. 118. (*Ed.*)

Wheat is grown in Egypt entirely as a winter crop. Owing to the wheat harvest taking place in April-May, it cannot advantageously be followed by cotton, therefore the wheat land is left fallow until July-August, when maize may be planted, or until October or November, and then bersim (*Trifolium alexandrinum*) is sown.

FLAX-GROWING IN EGYPT. — In *Bulletin* No. 12, *Technical and Scientific Service, Ministry of Agriculture, Egypt*, an account is given of an experiment in flax-growing which has been conducted at the Government Farm at Guemmeiza with the object of determining the amount of seed which yields the best results with reference to both seed and fibre. The best fibre and the largest yield were obtained from the most thickly sown plots, but the amount of seed secured was smaller than in the less thickly sown plots. On some of the plots, the stalks were gathered before the seed had been completely formed, so as to obtain the best possible fibre, whilst sacrificing the seed-crop. Other plots were harvested at a later date, in order to obtain both fibre and seed, and a third series were left still longer with the object of obtaining a good crop of seed. The seed obtained from the 2nd and 3rd series of plots was found to contain approximately the same percentage of oil; this is in harmony with the results obtained in England by EYRE and FISHER (*Bulletin of the Imperial Institute*, 1916, Vol. XIV, p. 115). The supposition that good flax can only be obtained by harvesting the crop before the seed is ripe, was not supported by the results of this trial; the best return for the fibre crop per feddan was secured in the latest harvest.

A sample of flax straw produced in the course of these experiments was sent for examination to the Imperial Institute in 1917. It consisted of retted flax stems from 26 to 30 in. in length and from $^1/_{16}$ to $^1/_8$ in. in diameter; it yielded about 25 per cent. of soft, fairly lustrous fibre usually about 24 in. long; the strength was irregular. The extracted fibre was valued at £ 200 per ton in London in January 1917; in normal times it would be worth about £ 60 per ton.

COTTON CULTIVATION IN AUSTRALIA (1). — The climatic conditions of large areas in the warmer parts of Australia are well adapted for the growth of cotton. At the present time, however, it is cultivated to only a small extent in Queensland and the Northern territory. The chief difficulty is the high cost of picking, as so far, no satisfactory cotton-picking machine has been found. It is thought that the labour difficulty might be overcome by growing the crop in small areas only, which could be picked by the family of the cultivator. The British Cotton Growing Association and the Government encourage the industry by different means, by: making a grant, providing seed for experiment and guaranteeing a minimum price, etc. Samples of cotton grown in Queensland, Western Australia and New South Wales have been received at the Imperial Institute in recent years. Their quality varied from mediocre to good; the samples from New South Wales were on the whole the most promising.

(1) See *B.* 1911, No. 2578. (*Ed.*)

FIBRES FROM VARIOUS SOURCES. — Description of a number of fibres examined in recent years at the Imperial Institute. Table II gives the composition and the value of these fibres.

TABLE II. — *Composition and Value of Fibres from various Sources.*

Fibre	Source	Analysis							Estimate per metric ton
		Moisture %	Ash %	A. Hydrolysis loss %	B. Hydrolysis loss %	Acid purification loss %	Loss on washing in water %	Cellulose	
Hibiscus cannabinus .	Egypt	11.1	2.7	4.1	7.6	4.6	[1]) 2.0	76.8	£ 30
H. cannabinus . . .	Rhodesia	9.4	1.3	17.3	18.3	4.9	2.6	71.2	£ 27
H. cannabinus . . .	Nyasaland	10.8	3.2	17.9	21.7	8.0	3.6	71.6	£ 37
Sida rhombifolia . . .	Swaziland	11.6	2.3	13.2	19.6	5.9	4.6	70.5	£ 17 — £ 18
Agave sisalana . . .	Rhodesia	7.4	0.6	9.3	11.7	1.1	1.3	80.5	£ 65
Furcraea gigantea . .	Rhodesia	10.1	1.6	14.8	17.8	4.4	—	72.0	£ 34 — £ 35
F. gigantea	S. Africa	9.9	1.3	13.8	16.3	2.8	—	72.7	£ 20 — £ 21
Asclepias fruticosa (fibre of stems) . .	S. Africa	8.0	1.5	13.1	16.2	7.0	—	82.0	£ 32 — £ 38
A. fruticosa (floss). .	S. Africa	—	—	—	—	—	—	—	£ 25 — £ 30
Kapok	Sudan	—	—	—	—	—	—	—	
Kapok	Togoland	—	—	—	—	—	—	—	
Nettle fibre (freed from gum)	Bengal	—	—	—	—	—	—	—	£ 26 — £ 30

1) The water contained 0.75 % of alkali expressed as sodium carbonate.

A sample of the seed hairs of *Ipomœa albivenia* were also examined. Large quantitites of this material can be collected in Natal and Zululand, where it is known as Kaffir, or Natal, cotton. It is, however, not a very promising material, for the fibres are weak, and therefore difficult to spin or card. It is much less resilient than kapok, and therefore not so useful for stuffing upholstery. These seed-hairs might be used in the production of nitro-cellulose, but they contain much less cellulose than cotton (77.3 as against 95 to 96.5 per cent.). The raw fibre would not be sufficiently absorbent for use in surgical swabs, though it is more absorbent than untreated cotton.

NEW PAPER-MAKING MATERIALS. — The following substances were recently investigated at the Imperial Institute as sources of pulp for paper-making: — cladodes of *Ecdeiocolea monostachya* (fam. *Restiaceae*) from Western Australia; the wood of *Neoboutonia macrocalyx* (*Euphorbiaceae*) from the East Africa Protectorate; the bark of *Brachystegia Randii* (*Leguminosae*) from Rhodesia. The analyses of the substances are set forth in Table III. The first is of about the same value as Algerian esparto grass, the yield of pulp from the air-dry material being 44 per cent.; the second has good qualities and supplies from 46 to 50 per cent. according to treatment; the third yields from 32 to 35 per cent. of good pulp. It seems likely

that fibre of value for textile or cordage purposes could be prepared from *Brachystegia Randii* bark.

TABLE III. — *Analyses of Paper-making materials.*

	Moisture	Ash in dry material	Cellulose in dry material	Resin	Length of ultimate fibres
Ecdeiocolea monostachya	10.1 %	3.01 %	49.5 %	—	2.00 — 5.40 mm
Neoboutonia macrocalyx	10.5	1.9	61.0	3.5 %	1.02 — 1.27
Brachystegia Randii	11.8	3.4	43.9	—	1.27 — 2.54

SOME NEW OIL SEEDS FROM AMERICAN PALMS. — The oil seeds dealt with are: — the kernel of babassu and bassoba (*Attalea* sp., possibly *A. funifera*); tucan, or tucum, or large Panama nuts (*Astrocaryum* sp.); Paraguay kernels (*Acrocomia* sp.), which only differ from *A. sclerocarpa* in their smaller size. They contain respectively 4.2 - 6.5 - 6.0 per cent. of moisture, and yield 70.2 - 52.0 - 69.4 per cent. of fat in proportion to the dry matter.

The chemical characters of the oils and the composition of the palm kernel meal are given in Tables IV and V. These kernels seem to be a valuable addition to the oil seeds now utilised as sources of fat in the edible fat industry. The cakes made from them have a feeding value about equal to that of coco-nut cake.

TABLE IV. — *Chemical Characters of the Oils from American Palms.*

	Babassu kernels	Tucan kernels	Paraguay kernels
Melting point (in open tube)	26 °C	30.5°C.	—
Solidifying point of fatty acids . .	23 °C	27 °	21 °C.
Specific gravity at $\frac{100°\,C}{15°\,C}$. . .	0.868	0.867	0.865
Acid value	5.5	2.9	26.1
Saponification value.	249	249	247
Iodine value % (Hübl. 12 hours) .	15.6	11.6	28.5
Unsaponifiable matter %	0.3 %	0.3 %	0.3 %
Volatile acids, soluble.	5.8	3.8	6.5
» » insoluble	10.2	5.9	10.2

NUTS OF *Ricinodendron Rautanenii* (MANKETTI NUTS) FROM SOUTH-WEST AFRICA. — These nuts are the product of a euphorbiaceous tree growing in the South African veldt, and especially plentifully in the region between Tsumeb and the Okawango River. It forms vast forests near the Omaramba River.. The kernels of the nuts are oily and are eaten by

TABLE V. — *Composition of Residual Meals.*
(Calculated to Contain 7 per cent. of fat).

	Babassu kernel meal	Tucuman kernel meal	Paraguay kernel meal
	per cent	per cent	per cent
Moisture	8.5	8.4	8.7
Crude proteins	23.2	10.0	31.6
consisting of:			
True proteins	22.0	10.0	31.4
Other nitrogenous substances	1.2	nil	0.2
Fat	7.0	7.0	7.0
Carbohydrates	45.9	62.9	35.5
Fibre	10.6	9.5	11.7
Ash	4.8	2.2	5.5
Nutrient ratio	1:2.7	1:7.9	1:1.6
Food units	121.4	105.4	132.0

the natives. The average weight of the fruit (drupe) is: entire fruit 7.6 gm., the nut, 5.0 gm. and the kernel 0.7 gm. The kernels contained 4.1 per cent. of moisture and yielded 57.2 per cent. of bright yellow liquid oil, equivalent to a yield of 59.6 per cent. from the dry kernels. This oil had the following characters: specific gravity at 55° C., 0.928; acid value, 1.0; saponification value, 191.5; iodine value 133.6 per cent. (it is therefore a semi-drying oil). It appears that this oil can be used for food. It is, however, very difficult to extract the kernels, owing to the softness of the latter, and the extreme hardness of the shells.

The pulpy mesocarp should have a moderate nutrient value, but trials would be necessary before it could be definitely recommended as a cattle feed. Its percentage composition is as follows: moisture 16.6; crude protein, 7.9, (of which 6.5 is true protein and 1.4 other nitrogenous substances); fat, 1.62; carbohydrates, etc. (by difference), 65.4; cellulose, 3.0; ash, 5.5; nutrient ratio 1 : 8.6; food units, 89.

THE PRODUCTION OF SANDALWOOD OIL IN MYSORE, BRITISH INDIA. — The source of true sandalwood oil is the heartwood of the trunk and larger roots of *Santalum album* Linn., a small evergreen tree native of South India, more particularly of Coorg and Mysore. It is estimated that about $\frac{7}{8}$ of the worlds' supply of sandalwood is derived from Mysore, in which State it is a Government monopoly, the extraction and exploitation of the wood being entrusted to the Forest Department. Before the war, about 52 per cent. of the sandalwood oil exported from India was sent to Germany for distillation; about 18 per cent. to the United States, and from 10 to 20 per cent. to the United Kingdom. The value of the total export of sandalwood from India in 1913-1914 was £ 128 626. In the two years that preceded the outbreak of war, the price of sandalwood oil in Mysore had doubled, the Government having restricted the amount offered for sale to about 2 500 tons, the estimated amount of the worlds' annual consumption. This restriction of output was to some extent justified in view of the ravages of

disease called the " spike ", which in recent years has caused the destruction of a large number of trees. The spike disease first appeared in 1900 ; the method adopted for its control consists in uprooting affected trees and is said to have checked its spread.

On the outbreak of war, the Government started the distillation of sandalwood oil in Mysore for export to Europe. The first factory was erected near the Institute of Science, at Bangalore; it is now producing 5000 lb. a month. A second factory is now being erected in Mysore ; it will ultimately have an output of about 20 000 lb. of oil per month, which will probably be sufficient to supply the whole of the European demand for this product. There is considerable demand for sandalwood in Eastern countries, where it is employed for perfumery and ceremonial uses, and also for carving.

Owing to the high price of true sandalwood oil, several substitutes have been placed on the market ; of these the chief is the oil obtained from *Amyris balsamifera*, a Rutaceous plant native of Venezuela, and known commonly as West Indian sandalwood. The so-called sandalwood exported from Australia is mainly derived from *Fusanus spicatus ;* in addition there is a small export of the South Australian sandalwood, *F. acuminatus*, or " quandong ", which goes principally to China and India.

Santalum album is grown in Celebes (Dutch East Indies) ; it is said to be grown in Java, and has also been successfully cultivated in Mauritius. The tree is semi-parasitic ; in India some 144 different trees have been recorded as serving as hosts, of which 26 are leguminous species. As *S. album* is of slow growth, it requires to stand from 20 to 40 years in order to develop the maximum amount of fragrant wood, therefore it is necessary to select as hosts, species of trees that have a life of at least 40 years. Probably trees of the leguminous family would be most suitable for the purpose, such trees as *Pongamia glabra* Vent., and *Albizzia Lebbek* Benth. commonly serving as hosts in India. In the matter of soil, *Santalum alba* does not appear to be very exacting, but the highest yields of oil have been obtained from wood grown on poor rocky soils.

South African Gum. — A sample of typical South African gum (probably derived from the " white thorn " *Acacia horrida*) had the following composition : moisture, 14.5 per cent. ; Ash, 2.9 per cent. ; matter insoluble in water, 2.0 per cent. ; Acid number, 3.9 ; relative viscosity of a 10 per cent. solution at 22° C., 8.0. This sample yelded a mucilage possessing good adhesive properties.

Burmese Black Varnish or Lacquer. — This is a natural varnish obtained by making incisions in the bark of the " black varnish tree " (*Melanorrhoea usitata*), one of the *Anacardiaceae*, which occurs in various parts of Burma, in Manipur and Siam. In 1914-1915, the different Forest Circles of Burma produced 3 390 cwts, of which the value was £ 1 138. A sample examined at the Imperial Institute contained : moisture, 5.3 per cent. ; ash, 0.2 per cent ; matter insoluble in benzene, 2.6 per cent. It was found that the varnish required about 3 days to harden in an atmosphere saturated at a temperature of 30-35° C. The length of time that this

varnish takes to dry is a obstacle to its employment. Further, it is very similar to Chinese and Japanese varnish; the latter is derived from *Rhus vernicifera*.

CHICORY SUBSTITUTE FROM SOUTH AFRICA. — The inhabitants of certain parts of South Africa, notably the Waterberg and Zoutpansberg districts of the Transvaal, utilise the dried roots of the "witgatboon" (*Capparis albitrunca*) as a substitute for chicory. A firm of chicory manufacturers in London who were commissioned by the Imperial Institute to examine this product, stated that it was a very good substitute for chicory. In February 1917, the price of the root in South Africa was stated to be 20s. per 100 lb.

TOBACCO FROM NORTHERN PROVINCES, NIGERIA. — Tobacco is grown for native use in almost every part of the Northern Provinces, Nigeria. The crop is carefully cultivated and manured, but the method of curing it is primitive and the product quite unfit for export. In 1915, experiments were inaugurated by the Agricultural Department with the object of producing a "bright" tobacco of the Virginian type. Trials were started at Maigana and Ilorin Experiment Stations. The extreme dryness of the air at the former Station made it difficult to handle the crop successfully, but at Ilorin the results were distinctly promising. Four samples of tobacco produced at Ilorin (3 American varieties, Boyd, Yellow Prior, and Sterling, and one indigenous variety, Native) were examined in 1916 at the Imperial Institute, and found to be of good quality. The excess of nitrogen and nicotine which they contained is no doubt due to the recent and abundant use of nitrogenous fertilisers.

The results of chemical examination expressed on the material conditioned to contain 12 per cent. of moisture are shown in Table VI.

TABLE VI. — *Analyses and Valuation of Tobacco Grown at the Ilorin Experiment Station, Nigeria.*

	Boyd	Native	Yellow Prior	Sterling
Analysis of tobacco:				
Moisture	12.0 %	12.0 %	12.0 %	12.0 %
Nicotine	4.2	3.9	4.1	4.4
Nitrogen	2.9	2.3	3.5	2.7
Ash	17.5	15.0	17.6	14.5
Analysis of Ash:				
Lime (CaO)	28.9 %	29.8 %	31.5 %	32.4 %
Magnesia (MgO)	6.9	7.5	6.4	7.7
Potash (K_2O)	17.4	17.9	17.1	17.7
Soda (Na_2O)	2.1	1.9	1.9	1.4
Sulphates expressed as sulpuric acid (SO_3)	1.3	1.1	1.5	1.4
Chlorides expressed as Chlorine (Cl).	0.9	2.4	1.7	1.0
Value of samples per lb.	8 *d.* to 9 *d.*	6 *d.* to 6 ½ *d.*	8 *d.* to 9 *d.*	7 *d.* to 7 ½ *d.*

CROPS AND CULTIVATION.

6 – **On the Origin of "Terra Rossa" (Red Soil) in Italy** (1). — GORTANI, M., in *Mondo sotterraneo*, Year IX, No. 6, pp. 125-131 ; summarised by TISSI, E. in the *Bollettino del R. Comitato Geologico d'Italia*, Vol. XLVI, Part 2-3, pp. 50-52. Rome, 1917.

The discussion on the origin of "terra rossa" is considered cronologically in the above communication. Formerly considered as a product of muddy eruptions, terra rossa had ended by being considered as the insoluble ferruginous clay residue from the dissolution of calcareous rocks due to atmospheric agencies.

The difficulty of admitting that a small insoluble residue of calcareous rock should be remain in place while the waters dissolve and transport the tens and hundreds of feet of thickness of the same rock, induced VINASSA and WALTHER to revive the question some years ago and to admit that the formation of "terra rossa" was largely due to the precipitation of the colloidal ferric hydrate derived from the iron compounds contained in the calcareous rock dissolved by surface water.

In 1911, CHELUSSI studied a large number of samples of "terra rossa" from the Carso of Trieste, the districts of Siena (Tuscany) and Aquila (Abruzzi), and northern Sicily. He found the samples to be composed of ferriferous or aluminiferous granules united with accessory minerals not identical, in quantity or quality, to the minerals present in the insoluble residues of the neighbouring calcareous formations.

In 1912, TUCAN, after having carefully studied and analysed many "terre rosse" from the Croatian Carso, arrived at the unexpected conclusion that they are not essentially constituted by a ferriferous clay, as was previonsly thought, but by an aluminium hydrate (sporogelite predominating), with which are associated the ferric hydrate and other minerals present in the insoluble residue of the limestones.

In 1913, the author, considering the studies previously mentioned, arrived at the conclusion that "terra rossa" is the insoluble residue of limestones and dolomites, essentially constituted of hydrates of aluminium (sporogelite), nearly always combined with hydrates of iron and other minerals, both authigenous and allothigenous, and that the formation of this soil could, speaking generally, be explained by VINASSA'S theory, modified in the sense that the precipitation of the colloidal aluminium hydrate is added or superposed to the precipitation of the colloidal ferric hydrate.

TUCAN does not accept these theories, but considers "terra rossa" (sporogelite and accessory minerals) as a primary formation already present in the limestone, and explains the presence of the insoluble residue by the sieve-like structure of the carsic rock being like a filter, owing to fractures and the slow action of atmospheric agencies. Change of the primitive

(1) See *B.*, 1915, pp. 1133–1138. (*Ed.*).

deposit can, according to TUCAN, give rise to colloidal secondary formations of oxides of aluminium, iron and manganese.

GALDIERI strongly contests these various theories, and recalls that limestone, as laboratory experiments have shown, dissolves completely in carbonic acid, in which also dissolves the alumino-ferruginous residue resulting from dissolving limestones in dilute acetic and hydrochloric acids, acids which do not exist in a free state in nature.

While studying the limestones and "terre rosse" of southern Italy, GALDIERI found that the residue left after dissolving limestones in acetic or hydrochloric acid does not completely correspond to the residue from "terra rossa". He draws numerous deductions from this fact and proposes to replace previous theories by a new one.

According to GALDIERI, "terra rossa" is simply an aeolian deposit, and in support of such an interpretation he recalls :

a) the unstratified nature of the deposits of "terra rossa" ;

b) its predominance in semi-arid regions ;

c) its presence on tablelands covered with vegetation (which are the places most liable to the accumulation of aeolian deposits ;

d) its mineralogical and morphological constitution.

Further, the fact that "terra rossa" is usually found on pure limestone has been exaggerated, so GALDIERI thinks, on account of theoretical conceptions ; in any case, he explains it by the permanency of pure limestone and its great permeability. GALDIERI attributes the high iron-content of "terra rossa" to the fact that it is retained in the state of a colloidal hydrate because of the special physico-chemical conditions of both it and the medium. He is of the opinion that the presence of aluminium hydrate is due to a true process of laterisation carried out under warmer climatic conditions than the present ones.

The author remarks that, to be able to judge the value of GALDIERI's theory, it would be necessary to carry out long researches not only in those regions studied by the latter, but also in other regions where the deposits of "terra rossa" are on a larger scale.

Speaking broadly, the writer observes that GALDIERI's strong criticism of the fundamental idea generally admitted cannot be considered as final, but in any case, no matter what the fate of his hypothesis, it has certainly been the means of stimulating more close and searching attention to the questions concerning the origin of "terra rossa".

7 – **Adsorption by Soils.** – HARRIS, J. E., in *Phys. Chem.*, XXI, 454-473, 1917 ; abstracted in *Journal of the Society of Chemical Industry*, Vol. XXXVI, No. 19, p. 1057. London Oct. 15, 1917.

Experiments were undertaken to determine whether the acidity of those soils which redden litmus paper, but whichgive a neutral solution, is due to colloidal adsorption. Soil was placed in contact with dilute solutions of barium chloride for 24 hrs., with occasional shaking, and the barium in solution before and after the treatment determined. When the results were calculated according to the equation $\frac{x}{m} = ac^{\frac{1}{n}}$ (1), representing the adsorption

isotherm, the values obtained for $\frac{I}{n}$ were constant showing that the action was one of adsorption and not of double decomposition. No chlorine was adsorbed from the barium chloride. Solutions containing other metallic ions were also used, and it was found that the number of equivalents absorbed was the same for ions of the same valency and increased with the valency, except in the case of potassium, which was adsorbed by soil in very high quantity. The potassium absorbed could be recovered by treatment with salt solutions, again in the order of the valency of the metal. When a soil was treated with a solution of two salts, the number of equivalents of each metallic ion adsorbed was less than with each salt separately, but the total number was greater.

8 - **Studies on the Organic Matter of the Soil of the United States.** — I. GORTNER, R. A. (Agricultural Experiment Station, University of Minnesota), Some Data on Humus, Humus Carbon and Humus Nitrogen, in *Soil Science*, Vol. II, No. 5, pp. 395-441, 16 fig., bibliographical index of 31 publications + II plates. New Brunswick, 1916. — II. IDEM, A Study of Carbon and Nitrogen in Seventeen Successive Extracts, with Some Observations on the Nature of the Black Pigment of the Soil. *Ibid.*, Vol. II, No. 6, pp. 539-548, 1 fig., bibliographical index of 5 publications, 1916. — III. IDEM, On the Production of Humus from Manures. *Ibid.*, Vol. III, No. 1, pp. 1-8, bibliographical index of 8 publications 1917. — IV. GORTNER, R. A. (Associate Bio-chemist) and SHAW, W. M. (Assistant in Soils Agricultural Experiment Station, University of Minnesota). Some Data on Humus — Phosphoric Acid. *Ibid.*, Vol. III, No. 2, pp. 99-111, bibliographical index of 24 publications. 1917. — V. MORROW, C., A. (Professor of Chemistry, Nebraska Wesleyan University) and GORTNER, R., A. (Associate Professor of Agricultural Bio-chemistry, University of Minnesota), A Study of the Nitrogen Distribution in Different Soil Types. *Ibid.*, Vol. III, No. 4, pp. 297-331, bibliographical index of 50 publications, 1917.

Since the time of LIEBIG, the nature of the organic matter of the soil has interested chemists, and every year sees extensive contributions to the voluminous literature upon this interesting subject. Mr. GORTNER has chiefy turned his attention to the solution of the following problems:

a) Is the humus, the ammonia, or alkaline hydroxide extract of soils a typical soil product, formed in the soil by the action of bacteria, or can similar extracts be obtained from unchanged vegetable material?

b) Does the humus, "the matière noire" of Grandeau, consist entirely of one or more black compounds, or does it contain in addition a greater or less proportion of colourless substances whose presence is masked by a black pigment?

c) Does a 4 per cent. sodium hydroxide solution extract the same substances and in the same proportion as a 4 per cent. ammonium hydroxide solution?

d) Is the soil nitrogen present in a form different from that in which the nitrogen occurs in plant materials, or does the nitrogen of the soil exhibit the same solubilities as vegetable nitrogen?

I. — DATA RESPECTING HUMUS, ITS CARBON AND NITROGEN. — The writer selected air-dried samples of: 8 mineral soils; 3 peats; 1 very acid

(1) FREUNDLICH equation: $\frac{x}{m}$ being the concentration of the adsorbed substance in the adsorbent, c the equilibrium concentration of the solution; a and n are two coefficients variable with the temperature and the nature of the substances employed. (*Ed.*).

"muck" soil; 5 kinds of unaltered vegetable material and in these he estimated the :

1) total carbon and total nitrogen.

2) Carbon and "humus" soluble in 4 per cent. ammonia before and after leaching the samples in 1 per cent. hydrochloric acid.

3) Carbon and nitrogen soluble in 4 per cent. sodium hydroxide, both before and after leaching.

4) Carbon and nitrogen extracted by 4 per cent. sodium hydroxide from the *residue* remaining after the samples had been extracted with 4 per cent sodium hydroxide and then leached with hydrochloric acid.

5) Carbon and nitrogen extracted by water from the residue of extract 4.

6) Nitrogen soluble in 1 per cent hydrochloric acid.

The various solutions were also submitted to colourimetric determinations.

From the numerous analytic data he obtained, the writer concluded that :

1) The humus extract of mineral soils and peats is not a typical soil product, for very similar extracts can be obtained from unchanged vegetable materials.

2) "Humus", the "matière noire" of Grandeau, does not consist of one, or more, black compounds, but it also contains a large proportion of almost colourless substances, the presence of which is normally masked by the black colour. In fact, the humus extract of Sphagnum peat, of brown peat, or of unaltered vegetable material, has a red-brown colour which only appears black in concentrated solutions.

3) A 4 per cent. solution of sodium hydroxide does not extract either the same substances, nor the same quantity of substances as does a 4 per cent. solution of ammonium hydroxide. Thus, from a given soil, after leaching with 1 per cent. hydrochloric acid, ammonium hydroxide will extract *less carbon* and at the same time *more colour* than will a sodium hydroxide solution.

4) In general, the forms of soil nitrogen appear to be quite similar to those forms occurring in unchanged vegetable materials (sweet fern leaves, oak leaves, oat and lucerne plants) except that they are less soluble in 1 per cent. hydrochloric acid and in 4 per cent. sodium hydroxide.

5) All the mineral soils studied and one calcareous peat, contained a *very dark* soil *pigment* which is absent from the unchanged vegetable materials. This pigment appears to be the only substance which can, with certainty, be said to be a true soil product. It is suggested that perhaps it is of bacterial origin, but as it contains a relatively small proportion of nitrogen, it would appear to have but little importance, *per se*, in the problem of soil fertility.

6) Inasmuch as the "humus" extract of soils is undoubtedly a mixture of organic compounds, many of which are colourless, and in all probability are extracted from unchanged plant or animal materials, and inasmuch as the soil pigment present in this solution probably rarely exceeds 40 per cent. of the "humus", a determination of the "humus" as ordinarily carried out, appears to be wholly without scientific justification. It ap-

pears to be far preferable to determine the humus from the total organic carbon.

II. — A STUDY OF CARBON AND NITROGEN IN 17 SUCCESSIVE SOIL EXTRACTS. OBSERVATIONS ON THE NATURE OF THE BLACK PIGMENT OF THE SOIL. — With a view to isolating this pigment, the writer proceeded as follows:

A sample of silt loam was leached with 1 per cent. hydrochloric acid and then extracted 10 consecutive times with fresh portions of a 4 per cent. sodium hydroxide solution. A sample of the residual soil was removed in order to determine the carbon, nitrogen and humus present. The remainder was further extracted for 4 consecutive times with a 25 per cent. solution of sodium sulphate (to act on the flocculation of the clay), then twice consecutively with the same solution to which was added 25 per cent. sodium hydroxide solution. Part of the residue was used for the determination of the carbon and nitrogen; the remainder was again leached with hydrochloric acid, and then extracted with 1 per cent sodium hydroxide solution. The extract obtained was divided into 2 portions: one for the determination of the carbon after the flocculation of the clay by potassium sulphate, the other for the determination of the humus after the flocculation of the clay by ammonium carbonate. The final residue was dried and used for the humus determination. The black pigment was separated by precipitation with sulphuric acid from the extracts obtained with sodium sulphate.

The writer arrived at the following conclusions:

1) The black soil pigment does not dissolve in 4 per cent. sodium hydroxide; this agrees with the writer's earlier observation.

2) This pigment is soluble in very dilute sodium hydroxide solutions, but is at once precipitated if the amount of the sodium hydroxide is increased to 4 per cent.

3) This pigment is also precipitated by salts of the heavy metals. It forms a water-soluble compound with ammonia when an ammoniacal solution is evaporated to dryness. It is not dialysable.

4) Two attempts were made to prepare the soil pigment in a pure form, but the resulting products contained such a high content of ash (37.47 and 51.17) that the ultimate analysis was unreliable. The pigment with the least ash content gave: Carbon, 61.3 per cent.; Oxygen, 31.6 per cent.; Nitrogen 2.8 per cent.; all calculated to an ash-free basis..

5) The first 6 extractions with sodium hydroxide removed relatively more nitrogen than carbon from the soil, but the remaining 3 sodium hydroxide extractions, as well as the 6 pigment solutions, contained relatively more carbon than nitrogen. The final soil residue had a ratio of carbon: nitrogen very much higher than that of the original soil.

III. — THE PRODUCTION OF HUMUS FROM MANURES. — In order to study this question, the writer carried out the following experiment:

Four earthernware jars, each provided with a hole in the base for drainage, were filled with a mixture of sub-soil and organic materials as follows:

Jar 1: — 7 500 gm. of moist sub-soil + 500 gm. of a mixture of silk waste and quartz, containing 4.50 per cent. nitrogen, indicating that about 140 gm. of protein had been added.

Jar 2: — 7 500 gm. of moist subsoil + 460 gm. of a mixture of 1/3 cleaned wool and quartz flour, containing 4.53 per cent. of nitrogen.

Jar 3: — 7 500 gm. of moist subsoil + 50 gm. of powdered calcium carbonate + 300 gm. high grade "patent" flour.

Jar 4 : — 7 500 gm. of moist subsoil + 300 gm. alfalfa meal.

A sample was taken of each of these mixtures which was dried in the air, bottled, and set aside for analysis. The remaining soil was placed in the earthenware jars and moistened with water containing approximately 50 cc. of an almost clear suspension of soil bacteria. All of the jars were then planted with barley, but as poor growth was obtained in some of them, the vegetation test was soon discontinued, the barley stalks cut off, and the jars of soil allowed to remain in the greenhouse under fallow conditions, care being taken to keep the air moist.

At the end of one year, samples were taken from each jar representing depths of 0-3 inches and 4 to 6 inches ; these samples were dried at 65° C., ground to pass a 1 mm. sieve and bottled for analysis. The remainder of the soil was left in the jar for further action by bacteria and fungi.

During the course of the experiment, some changes were observed in jars 1 and 2. A fortnight after the experiments were started, there appeared in the soil of jar 1, black streaks about 4 to 5 mm. below the surface. In jar 2, there was a layer of black soil 3 to 4 mm. thick, and about 5 mm. below the surface. Below these streaks or layers, the soil was again of its original colour. On the other hand, no noteworthy changes in coloration were to be observed in jars 3 and 4, even after the experiment had been started for one year, though after this period, purple spots appeared throughout the soil of jar 1 and a mould odour, as well as mould mycelia were easily observed. The soil of jar 2 was similar to that of jar 1 except that the spots were black. The soil from jars 3 and 4 had a mouldy odour, but no black or purple coloration, so that the presence of mould mycelia cannot be definitely taken as the causation of the black or purple colours.

The determinations of the organic carbon, nitrogen and humus made at the beginning and end of the experiment gave the following results :

1) In all the jars there was observed a decided loss of organic carbon, ranging from 18.4 to 55 per cent. of the carbon originally present.

2) There was likewise a loss of nitrogen, but this loss was not proportional to the loss of organic carbon, ranging from 5.0 to 26.5 per cent. of the nitrogen originally present.

3) There was a loss of humus soluble in 4 per cent. ammonia, and this loss was proportional to the loss of nitrogen. Whether, however, there is a causal relationship here can only be determined by more extended work.

4) As regards the humus extract by 4 per cent. ammonium from the unleached soil, no significant change was apparent in 3 of the jars, but in the 4th, there was a loss of 60 per cent.

5) These experiments furnish no evidence that an increase of soil " humus " is brought about by specific humification. On the contrary, all the evidence is directly opposed to such a conclusion, and it appears altogether probable that the maximum amount of ammonia soluble material is present in the soil immediately after a green manuring crop has been ploughed under, and before the " humifying " bacteria or fungi begin their work.

IV. — Some data on Humus Phosphoric Acid. — The writers determined the phosphoric acid extracted from soils, peats and unchanged vegetable materials : *a*) by means of 1 per cent. hydrochloric acid ; *b*) by 4 per cent. ammonia, after leaching with the above acid ; *c*) by ammonia without leaching with hydrochloric acid.

The different extracts were evaporated to dryness and the burnt residue was used for analysis. The following conclusions have been reached :

1) Of the 8 mineral soils investigated, 7 yielded more phosphoric acid when extracted with 4 per cent. ammonia than when 1 per cent. hydrochloric acid was used; only in 1 soil did hydrochloric extract appreciably more phosphoric acid than did the ammonia.

2) There appears to be no relation between the amount of phosphoric acid (P_2O_5) extracted by ammonia from the soil unleached with hydrochloric acid (HCl.) and that extracted after leaching.

3) The amounts of humus-phosphoric acid present in the 8 soils studied, when compared with the known fertility of these soil types, do not support the theory that a high humus-phosphoric acid content is a necessary factor in soil fertility.

4) Probably the greater part of the phosphoric acid present in humus ash is inorganic in nature, being derived from the colloidal clay and from the phosphoric acid (P_2O_5) adsorbed by the colloids present in the ammonia solution. No method of analysis has yet been proposed which will distinguish between such adsorbed phosphoric acid and organic phosphoric acid.

5) There is no relationship detectable between the total nitrogen content of the soil and the phosphoric acid (P_2O_5) extracted by the different treatments.

6) The amount of "humus ash" (even when the extractions have been carried out under identical working conditions) is extremely variable, from 6.7 to 32.6 per cent. Such a wide divergence can only be accounted for by the presence of considerable amounts of clay, or adsorbed mineral materials.

7) The "humification" of vegetable materials in contact with a mineral soil for an entire year did not increase the humus-phosphoric acid over that contained in the original subsoil.

8) What has been said regarding the colloidal adsorption of phosphoric acid (P_2O_5), applies with equal force to determinations of humus-potash, and it is most probable that organically-bound potash does not occur in the soil in appreciable amounts, but that this alkali is found everywhere in a mineral condition and adsorbed.

V. — NITROGEN DISTRIBUTION IN THE DIFFERENT SOIL TYPES. — In these investigations, the writers used the following substances:

a) Fibrin hydrolysed in the presence of an ignited mineral subsoil, in the presence of stannous chloride.

b) A calcareous black peat.

c) An acid sphagnum-covered peat, hydrolysed alone, in the presence of a mineral subsoil, and in the presence of stannous chloride.

d) Seven samples of mineral surface soil: 1 clay loam — 3 silt loams — 1 prairie-covered loess — 1 forest-covered loess.

e) An acid "muck" soil.

f) Extracts of sphagnum-covered peat soluble in: 1 per cent. hydrochloric acid; 1 per cent. sodium hydroxide and not precipitated by hydrochloric acid; 4 per cent. sodium hydroxide but precipitated by hydrochloric acid.

For the separation by hydrolysis, and the determination of the

different forms of nitrogen the writers used the VAN SLYKE method (1), modifying it a little, in order to obtain the following categories:

Total nitrogen.
Ammonia nitrogen.
Humin nitrogen (under the form of "humin") insoluble in soil.
Humin nitrogen, precipitated by calcium hydroxide.
Total humin nitrogen.
Basic nitrogen set free as ammonia by 50 per cent. potassium hydroxide.
Basic nitrogen not set free by this treatment.
Amino-nitrogen of bases.
Non-amino-nitrogen of bases.
Amino-nitrogen in filtrate from bases.
Non-amino nitrogen on this filtrate.
Total nitrogen regained.

From the many results obtained, the writers conclude as follows:

1) The figures for the ammonia nitrogen in a protein analysis are not appreciably changed when the hydrolysis is carried out in the presence of the protein material.

2) The "humin" nitrogen is greatly increased by hydrolysis in the presence of ignited mineral soil. The histidine fraction entirely disappears.

3) The analysis of a pure protein in the presence of an ignited mineral soil does not give reliable results for the different fractions. Therefore the figures obtained for the nitrogen distribution in soils are of value only when used for purposes of comparison. Such data should not be compared with analyses of pure proteins.

4) Since practically all the mineral soils investigated give furfurol on treatment with an acid, it is very likely that a considerable amount of the total humin nitrogen found is due to the presence of carbohydrates in the soil which give rise to furfurol during hydrolysis. This may combine with certain of the nitrogen compounds of the soil and cause an increase in the humin nitrogen, as well as adsorb or occlude nitrogenous compounds in the "humin" formed from furfurol by polymerisation.

5) Special attention should be given to a new fraction of nitrogen discovered in these investigations. This is a fraction removed from a colourless solution by the addition of calcium hydroxide (3.26 to 9.21 per cent. of the total nitrogen). It must consist almost entirely of non-protein substances, since the organic substances in this precipitate are colourless

(1) VAN SLYKE D. D.: I. Eine Methode zur quantitativen Bestimmung der aliphatischen Amino-gruppen; einige Anwendungen derselben in der Chemie der Proteine, des Harns und der Enzyme, in *Berichte der Deutschen Chemischen Gesellschaft*, Vol. 43, pp. 3170-3181, 1910. — II. The Analysis of Proteins by Determination of the Chemical Groups Characteristic of the Different Amino-Acids, in *Journal of Biological Chemistry*, Vol. 10, pp. 15-55. 1911. — III. The Quantitative Determination of Aliphatic Amino Groups, *Ibid.*, Vol. 12, pp. 275-284, 1912. — IV. Improvements in the Method for Analysis of Proteins by Determination of the Chemical Groups Characteristic of the Different Amino-Acids, *Ibid.*, Vol. 22, pp. 281-285.

and adsorbed by, or combined with, the metallic hydroxides (of calcium, aluminium, iron).

6) *True* humin nitrogen (22.93 to 28.27 per cent.) remains in the residual soil after hydrolysis, in company with non-humin nitrogenous compounds.

7) The strength and volume of the hydrochloric acid used in hydrolysis has little effect on the nitrogen distribution of the hydrolysate, provided acid as strong as constant-boiling acid is used, in the proportion of at least 2 parts of acid for 1 of soil. In this manner, the writers extracted on an average 72.19 per cent. of the total nitrogen, with a minimum of 66.63 per cent, and a maximum of 77.65 per cent. The average of the results obtained by other investigators in the case of 37 very different soils, appears to be 75.19 per cent of the total nitrogen.

8) On comparing different soils, it is seen that organic nitrogen dissolves during hydrolysis to almost the same extent, regardless of the origin and nature of the soil,

9) On comparing the different extracts from sphagnum-covered peat, very interesting results were obtained. The portion soluble in sodium hydroxide and ***not*** precipitated by hydrochloric acid, gave a nitrogen distribution approximating very closely that of a normal plant protein. On the other hand the nitrogen dissolving in the preliminary hydrochloric acid leaching showed a nitrogen distribution which is certainly not due exclusively to protein materials, *e. g.* an ammonia nitrogen percentage of 65.40 and amino-nitrogen in filtrate from bases, of 17.11 per cent.

10) The most significant fact brought out by this study is, that the nitrogen distribution is very *uniform* in *different soil* types. This is to be expected, seeing that the nitrogen distribution in soils is an *average* distribution of all the plant and animal nitrogenous products that find their way into the soil.

9 - **Construction and Use of Farm Weirs for Measuring Small Streams of Irrigation Water, in U. S. A.** — *United States Department of Agriculture, Farmers' Bulletin* 831, 18 pp., 5 fig., 7 tables, bibliographical index of 20 publications. Washington, June, 1917.

Irrigation is becoming more and more extensive in the arid west of the United States. In order to measure the water supplied by irrigation concerns, the author describes the construction of weirs for measuring comparatively small streams of flowing water.

The weirs described are : *a*) the rectangular ; *b*) the CIPOLLETTI (trapezoidal) ; and *c*) the 90° triangular-notch types. The latter form deserves to be more widely used than at present for measuring small quantities of water.

The dimensions for constructing permanent or temporary weirs are given, as well as discharge tables calculated for various heights of water by the ordinary formulae.

The bulletin closes with a list of 20 publications of the U. S. Department of Agriculture relating to irrigation.

10 – **Electrocultural Experiments in Great Britain and France.** — I. BLACKMAN, V. H. and JÖRGENSEN, J. (Imperial College of Science and Technology), The Overhead Electrical Discharge and Crop Production, in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 1, pp. 45-49, figs. 5. London, 1917. — II. JÖRGENSEN J., in *The Electrical Review*, pp. 452 and 454, October, 1916; pp. 499-501, November 1916; pp. 21-23, July, 1915, London. — III. ANGOT A., PETIT, H., SAGNIER, H., MANGIN, L. and SCHRIBAUX, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 37, pp. 1051-1062. Paris, 1917.

I. — The account of experiments carried out in 1916 at Lincluden Mains Farm, Dumfries, and continuing those of previous years (1). The object was to study the effect of the overhead electric discharge upon crop production, the experimental crop being oats.

Description and Treatment of Selected Area. — A large field of 9 acres, which had in the past given uniform crops, was selected; the soil was a sandy loam. It had been pastured without manure for the 3 previous years. One acre was chosen as the electrified area; the sides of the rectangular plot measured 88 by 55 yds. Two half-acre control plots were chosen at such a distance from the electrified plot as to receive practically no discharge. The difficulty of confining the discharge to the special area to be electrified was much reduced by keeping the wires low (2). The distance of the control plots, together with the low position of the discharge wires, made the use of the earthed screen of wire netting previously used to prevent the spread of the discharge to the control areas, unnecessary.

The overhead discharge was applied by means of a series of 21 wires running parallel to the sides of the rectangular special area. The wires were about 4 ½ yds. apart and supported at their ends at about 7 ft. above the ground (at the end of the experiment, the wires had sagged downwards to a height of only 6 ft.). One end of the wires was connected to the soil and the other to the secondary circuit of an induction coil, producing a potential of about 90 000 volts on the wires. Two ball interrupters, placed in the circuit, gave sparks some 6 inches long. A series of LODGE valves were introduced to reverse the current (3). The primary circuit of the induction coil received, through a rotary mercury interruptor, a 3-ampere current at 50 volts, as in preceding years, but the intensity of the discharges was much greater, the wires being so much closer together (13 ½ ft. against

(1) See *The Journal of the Board of Agriculture*, April, 1910, p. 16; January, 1912, p. 827; October, 1913, p. 582; January, 1915, p. 941; and October, 1919, p. 671 (*Authors' note*). — For an account of the 1915 Experiments at Lincluden, see *R.*, 1916, No. 1260. (*Ed.*)

(2) JÖRGENSEN and PRIESTLY have shown (*Journal of Agricultural Science*, Vol. VI, Part 3 pp. 337-518, 1914) that when the wires are fixed at a considerable height above the ground the wind may carry the discharge over a wide area. (*Authors' note*). — This article was summarised in *B.*, 1915, No. 17, under the title: *The Distribution of the Overhead Electrical Discharge Employed in Recent Agricultural Experiments.* (*Ed.*)

(3) See *The Electrical Review*, October and November 1916 [illegible]

. ft. in 1915 and 19 ft. in 1914), as well as nearer the soil (7 ft. against 10 1915 and 14 in 1914) (1).

Effect of the Discharge on the Crop. — The oats were sown on March and appeared above ground on April 13, the discharge being started April 14. By May 16, there was a marked difference between the electified and the control areas ; the plants which had received the discharge ere taller and of a deeper green colour than the others.

Measurements were taken at intervals of the average height of the ants of the three areas ; the results are given in the following table :

Plots	18th. June	25th. June	3rd. July
Electrified	10 in	24 in	32 in
Control I	14 »	19 »	21 »
Control II	12 »	18 »	20 »

Measurements were discontinued after July 3, it not being possible to t among the plants without damaging them The effect of the disarge was clearly visible for some distance round the electrified area, r the height of the crop round the area was above the average, gradually minishing with increasing distance.

The electrified crop was markedly taller than the rest of the field, is well shown in 2 photographs, taken on August 8.

The discharge was continued until August 17, being used only in the ytime and discontinued during rain. It was applied for 848 hours algether during the season.

Heavy rain storms set in during the latter part of August, causing conerable laying of the heavy electrified crop and delay in cutting. This l to failure to garner the whole crop, owing mainly to loss of grain before rvesting. The crop was cut on August 28 and 29, carted on September , and threshed on September 12. The yields in grain and straw are ven below.

	Grain			Straw
	1st Quality	2nd. Quality	Total	
ctrified Area (1 acre) . .	1 942 lb.	695 lb.	2 637 lb.	4 021 lb.
ntrol Area I (½ acre) . .	630 »	210 »	840 »	1 218 »
trol Area II (½ acre) . .	714 »	210 »	924 »	1 401 »

The electrified area, as compared with the control areas, gave an inased yield in grain of 49 per cent., and in straw of 88 per cent. If the

(1) The intensity of the charge received may be increased by: *a*) lowering the wires; educing the distance between the wires; *c*) reducing the thickness of the wires. The wire ed was silicium bronze of gauge 24. (*Authors' note*)

weather had been more favourable, the yield of grain would have been greater. The 1915 results, also with oats, but with a weaker discharge, gave 30 per cent. increase in grain and 58 per cent. increase in straw.

Financial Results. — Taking current prices in the district at the end of September, 1916 (oats, first quality, 3*s.* 9*d.* per bush.; 2nd. quality 3*s.* 1*d.* per bush.; straw, £ 2 15*s.* per ton), the increased value of the crop works out (with bushels of 42 lb.) at £6 7*s.* per acre.

The net profit is rather difficult to estimate. The apparatus used to produce the high-tension current was inefficient, not being such as would be used for work on a large scale; for every 100 watts in the primary circuit only 10 or 12 watts were obtained from the secondary one. Thus, with an efficient apparatus, the same cost would have enabled discharges to be made over a much larger area

In addition, current supply from a power station was not available so the supply was obtained from a small dynamo driven by a petrol engine. The cost of the current used, about 130 B. of T. units, when calculated at 1*d.* per unit, only works out at 11*s.* The cost of a large-scale installation cannot be estimated at present, but the profit shown above would permit of a heavy expenditure on an installation.

Residual Effect of Discharge. — A new and important aspect of the problem has been disclosed by the discovery that the application of the discharge one year may increase the next year's crop. The field in which the experimental crop was grown in 1915 was sown with grass and clover at the same time. The difference between the crop of clover-hay produced in 1916 on the electrified area of 1915, and that on the non-electrified area was very obvious, and there was a marked increase in the weight of the crop produced from the electrified area. Two photographs, taken on September 15, show the *second* crop of clover which had come up on the hay stubble of the first crop of clover hay had been cut in July, 1916. The difference in growth on the two areas was very marked. It should be noted that this field had been well limed before sowing the oats. This question of "after-effect" will be investigated in future experiments, as if the electric discharge may benefit a succeeding crop, its agricultural value will be greatly enhanced.

Problems still needing Investigation. — The writers conclude that the use of the overhead electric discharge is not sufficiently investigated as to warrant its practical adoption. The most suitable strength of discharge has yet to be ascertained, as well as the most economical methods of producing the necessary high tension current. There also remain the question of the light, humidity of the air, nature of the soil, etc., to be studied.

II. — An account of other electro-cultural experiments carried out in various districts of England in 1916. The following are the principal results:

Strawberries. — The electric discharge produced an increase in yield of 80 % for young plants, and of 25 to 30 % for old plants.

Potatoes. — Increased yield of 20 to 50 % bearing, not on the number of tubers, but on their size.

Carrots, Beets, Tomatoes. — Increased yield of from 25 to 50 %.

Leguminous Plants. — The immediate effect of the discharge was somehat harmful to these plants, which fix atmospheric nitrogen, whilst they enefited from the *after-effect* of the previous year's discharge, as was seen bove for clover.

The Electrical Review for July 6, 1917, describes a portable outfit conaining all the necessary apparatus for producing discharges over an area f from 1 $^1/_2$ to 2 $^1/_2$ acres. The maker offers to supervise the installation ersonally and supervise the working of the apparatus.

III. — At the meeting of the French Academy of Agriculture on November 28, 1917, M. ANGOT described Messrs. BLACKMAN and JÖRGENSEN's xperiments, as well as other trials carried out in England. The communiation was followed by a discussion, summarised below.

M. PETIT: The good effect of the electric discharge appears to be due to greater *mobilisation* of the elements necessary to plant-life. If the leguminus plants only profited from it the second year, it is because they derive o benefit from the nitrification of nitrogenous manures during the first ear; in fact, they suffer from excess of nitrogen. In continuing these xperiments attention should be paid to this danger: in using the soil, ood results might be obtained at first, but negative results might be btained after some years' time.

M. ANGOT: The authors of the Lincluden experiments make all neessary reserves themselves. It is not the soil that is electrified, for the ires are 7 feet above the ground; the discharges act directly on the lants.

M. H. SAGNIER: The question of the agricultural use of electricity is ot new to France. Several sets of experiments have been made concerning he action of electricity on plants. Thus, GRANDEAU carried out experiments in a metallic cage; a professor of the Agricultural Institute at Beauais invented a system similar to a lightning-conductor and which gave results varying from good to mediocre.

M. L. MANGIN: Many attempts have been made in France to utilise tmospheric alectricity; but it has but a feeble influence, and its use is mited, while in the experiment in Great Britain powerful currents were sed, obtained by induction coils, which is very different, especially in he intensity of the action on the plants.

M. SCHRIBAUX has made thousands of experiments with large metallic ages; he found no marked difference between plants growing in the cages nd those growing outside; the differences found seem due rather to experiuental errors, and atmospheric electricity does not seem to have produced ny noteworthy effect on the Gramineae experimented with. The poor results obtained in previous attempts were probably due to the agriculturist's ack of electrical knowledge and the physicist's lack of agricultural knowedge. The two experts should combine their efforts.

Finally, M. ANGOT considers that previous experiments cannot be compared with those made recently in Great Britain. In using atmospheric lectricity only a feeble potential is obtained; the current only increases

by 30 or 40 volts per yard of elevation; when the wires are placed from 12 to 16 ft. above the soil, less than 150 to 200 volts are obtained. On the other hand, industrial currents producing up to 90 000 volts were used in the trials in Great Britain, so no comparison whatever can be made between the two procedures. Plants sheltered under a cage are simply submitted to the action of atmospheric electricity, which also influences the plants outside the cages, but the difference is very small. At a few inches from the ground, the difference of potential between air and soil does not exceed a few dozen volts; this would explain the contradictory results obtained by M. SCHRIBAUX.

11 – **The Cultural Methods Applied to Winter Wheat in the Great Plains Area, U. S. A.** — CHILCOTT, E. C., COLE, JOHN S. and KUSKA, J. B., in *United States Department of Agriculture, Bulletin* No. 595, 36 pp. 19 tables. Washington, October 11, 1917.

The Office of Dry Land Agriculture of the U. S. Department of Agriculture began field work in the investigation of methods of crop production in the Great Plains area in 1906. In 1916, 24 Agricultural Stations were occupied with experiments in crop production.

The bulletin analysed compares the returns obtained with different methods of cultivating winter wheat, using for the purpose the results of 75 annual cultural experiments carried out on 1137 plots by 13 Stations (1) which had made cultural experiments for a period of at least 4 years.

The area covered by these investigations consists of about 400 000 square miles of territory. It includes the western portions of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas, and the eastern portions of Montana, Wyoming, Colorado and New Mexico. These experiments supplied a large number of details which are summarised in the bulletin, so as to give only the most general and most important results.

After examining the results of the experiments of the 13 Stations, each of which is considered separately, the writers came to the following conclusions:

None of the cultural methods investigated, when applied to winter wheat, can overcome extremely unfavourable climatic conditions. It is only in the case of rainfall deficit, that the cultural methods under investigation have shown important effects upon yields.

Reducing the cost of production has, in most cases, proved a more important factor in determining profits, than increasing the yields by cultural methods.

The average difference in yields between early (deep: 8 inches), and late (shallow: 4 inches), ploughing is 1 bushel per acre. At most Stations, the difference is small, while at others the advantage of one over the other depends on the season.

The preparation of the ground after harvest: furrowing with a lister, and levelling the ridges preparatory to seeding, have resulted in an average increase of 0.9 bushel per acre over early ploughing and 2.2 bushels per

(1) See *R.* April, 1917, No. 328. (*Ed.*)

acre over late ploughing. As it is a cheaper method of preparation than ploughing, it has consequently been more profitable.

Subsoiling has increased the yields over ploughing without subsoiling at 5 Stations out of the 10 at which it has been studied. In the other Stations, this method has been the least remunerative.

Disked maize ground has given consistently high yields. This, together with the low cost of preparation, has resulted in this method showing the highest net returns of any of the methods at all the 11 stations where it has been tried, except at Huntley and Amarillo.

Summer tillage has given the highest average yields of any method under trial. However, on account of its high cost, due to extra labour and alternate-year cropping, it has not netted the highest returns, except at Huntley.

Green manuring is the most expensive method under investigation. It has given the smallest net returns of any of the methods at all the stations, except Huntley, where the profit from it is slightly greater than from either autumn ploughing or subsoiling.

2 - **Method of Rice-Growing in Uncultivated Rice-Fields, in Italy.** — See No. 37 of this *Review*.

3 - **Improved Method of Sugar Cane Cultivation, in Salvador.** — See No. 46 of this *Review*.

4 - **The International Trade in Fertilisers and Chemical Products Employed in Agriculture (Half-Yearly Review)** (1). — *Bulletin of Agricultural and Commercial Statistics*. Year VII, No. 9, p. 731-786. International Institute of Agriculture, Bureau of Statistics. Rome, September, 1917.

This Review comprises nearly sixty pages, with a great number of data, either official or from trustworthy authorities. Separate headings are devoted to each of the principal fertilisers (*phosphatic, potassic and nitrogenous*) and chemical products employed in agriculture. The more important data are given below.

I. **The world's production.**

NATURAL PHOSPHATES. — The production of natural phosphates in the United States, after having undergone some decrease in 1914, was in 1915 only about one-half of that of 1913 but recovered somewhat in 1916. According to data supplied by producers, the aggregate of natural phosphates sold in the United States in 1916 was 2 014 196 tons, against 1 865 123 tons in 1915.

Florida has produced 47 843 tons of rock phosphate, and 1 492 327 tons of pebble. The small extent of production of the first mentioned will be noticed, having declined since 1915, from a total of nearly 500 000 tons in 1913.

The figures from South Carolina, continuously on the decline, afford only 3 898 tons, less than half the production in 1913.

The production of Tennessee and Arkansas for 1916 is 369 951 tons of brown rock phosphate and 48 447 tons of blue grey phosphate, making a total of 418 398 tons.

This total includes a small quantity of brown rock phosphate from Kentucky and shews a decided increase on the figures of 1915.

(1) See *R.* January, 1917, No. 13. (*Ed.*)

In the western states only Utah and Wyoming contribute to the production of rock phosphate, as Idaho has now ceased to produce. The quantity from those two States was 1 730 tons in 1916, less than half that produced in 1915.

Makers of fertilisers claim that the price of phosphatic fertilisers should show a much greater increase than that of the rough phosphate, and that this rise is required in order to meet the enhanced price of the sulphuric acid required in the preparation of fertilisers. It is anticipated that the improvement in the manufactured quantities of natural phosphates, manifest in 1916, will continue during 1917.

The production of Egypt in 1916, amounting to 125 008 tons, shows a decided advance on that of 1915, and this also applies to Tunis. On the other hand the data from the Dutch West Indies and the French settlements in Oceania indicate a marked decline.

The subjoined table contains the principal numerical data recently to hand with regard to this subject. These data appear in the review published by the International Institute of Agriculture in Rome.

Natural phosphates	1916	1915	1914	1913
	thousands of metric tons			
Spain	14	9	8	4
United States .	2.014	1.865	2.778	3.161
Dutch Antilles.	14	29	15	36
Algeria . . .	(*a*) 380	165	226	461
Egypt	125	83	72	104
Tunis	1.695	1.389	1.444	2.285
French islands in the Pacific	(*b*) 27	72	73	82

(*a*) Shipments. — (*b*) Shipments of the first nine months.

BASIC SLAG. — It is an exceedingly difficult matter to prepare an international table with regard to basic slag, in present circumstances. The production of Germany in the first ten months of 1916 was 1 592 thousands of tons, as compared with 2 500 in 1913. Production of this commodity has also decreased considerably in all other countries.

SUPERPHOSPHATE OF LIME. — The International Institute of Agriculture has published the following summary:

Superphosphate of lime	1916	1915	1914	1913
	thousands of metric tons			
Spain	315	194	220	225
France	350	600	1.600	1.920
Great Britain .	—	685	—	820
Italy	848	913	906	972
United States .	—	2 533	3 785	2 348

POTASH SALTS. — The German distribution department for production of potash has fixed the following aggregate for the year 1917:

Germany . . .	762 250 tons of pure potash
Other countries	155 200 " "
Total . . .	918 450

The deliveries of German potash salts in 1916 reached a total of 883 000 tons of pure potash, against 680 005 tons in 1915, 903 988 in 1914, and 1 110 370 tons in 1913. The considerable increase in the production of 1916 as compared with that of 1915 is explained by the fact that the requirements of German farmers have been better distributed over the whole year, and were consequently more uniformly met.

The production of potash salts in the United States in 1916 was estimated at 32 422 metric tons of products with an average of about 7 % of potash

epresenting a production of potash amounting to 8 818 tons. This is very early ten times the production of 1915, but no more than one-twentieth of the ormal consumption of potash in the United States.

NITRATE OF SODA. — The production of the Chilean nitrate beds in the rst half of 1917, was very nearly equal to that of the corresponding period in 916; being 1 482 122 metric tons in 1917 and 1 488 792 in 1916. In fact after n interval of a year and a half a production analogous to that of peace times as again been attained. In the first half of 1915 a minimum was established n a production of about 600 000 tons. The stocks on 30 June have never een so large as as those of this year, on the Chilean coast.

They amounted to 936 235 tons, while they were 919 102 tons at the ame date in 1916, about 850 000 tons in 1915 and 775 000 tons in 1914. In revious years the figures were still more moderate. The reason for this bnormal increase of stocks must be sought in the fact that, while production otals shew little change, the shipments to European and American markets ave been much hampered by the lack of tonnage and by the consequent nhancement of freight rates. These shipments represent during the first alf of 1917 a total of 1 230 947 tons against 1 356 629 tons in 1916, say 25 082 tons less in 1917.

These figures are however much larger than those of the first half year f 1915 which only reached 834 376 tons.

SULPHATE OF AMMONIA. — A production of 700 000 tons of sulphate of mmonia was expected in Germany for 1916, while, according to the most ecent available data, the quantity for 1915, was 549 000 tons.

Owing the to enormous demand for steel, both for European countries and or American foundries, and the fact of the production of ammonia being ased on the metal requirements, the production of sulphate in the United tates has greatly increased since 1914.

In 1916 this production of ammonia, reckoned in sulphate, was about 94 838 metric tons, or 47.7 % more than in 1915. The increase is still learer when the data are compared with those of 1914, when the production as only 166.016 tons.

For 1917 the American production of ammonia is estimated at 400 000 tons, eckoned in sulphate; and the capacity for production in 1918 may reach at east 500 000 tons.

The Japanese production of sulphate of ammonia is also continuously ncreasing. While in 1914 it scarcely exceeded 16 000 tons, it reached 31 824 1 1915 and in 1916 the total became 28 203 tons. For 1917 the estimate is o 802 tons, and some people predict a total of 60 000 tons. This increased roduction is due to the same causes that have influenced the output in merica.

The subjoined table summarises the information published by the Institute f Agriculture with respect to production of sulphate of ammonia from 1913 o 1916.

Sulphate of ammonia	1916	1915	1914	1913
	thousands of metric tons			
Spain	18	16	16	15
France	25	42	—	74
Great Britain	445	433	433	439
Netherlands	4	5	5	7
Russia	33	16	17	14
United States	295	227	166	177
Japan	38	32	16	8
Australia	7	7	6	5

CYANAMIDE OF CALCIUM. — Although some authorities estimate the German roduction of cyanamide in 1915 and 1916 at an aggregate of 600 000 metric ons, others do not reckon it at more than 400 000. We have adopted the

figure of 500 000 tons thus indicated as this appears to us not far from th reality. The American consular reports consider that, besides this productio of cyanamide, Germany will recover in 1917 nearly 500 000 tons of ammoni by the aid of the Haber process, which represents, for that country alone, a tota of nitrates extracted from the atomosphere, equal to 209 000 tons. If to thi are added the 140 000 tons of nitrates represented by the 700 000 tons o sulphate of ammonia expected in 1917 for that country, we find for Germa an available aggregate of 340 000 tons of nitrate, if we estimate the productio of cyanamide in 1917 as equal to those of 1916 and 1915.

There is nothing official in connection with these figures.

Nor is there any other country which provides official data as to th present production of cyanamide, and this may be readily understood, sin the whole, or very nearly the whole, of the nitrogenous products of this cla are reserved for war work. In the subjoined table we have embodied th estimate as to capacity for production of cyanamide that are made by exper in this question and published by the Institute of Agriculture.

Cyanamide of calcium	1916	1915	1914	1913
	thousands of metric tons			
Germany	500	500	36	24
Austria-Hungary	24	24	24	7
France	100	80	7	7
Italy	20	25	16	15
Norway	220	25	15	22
Sweden		16	18	18
Switzerland	29	12	7	7
Canada	64	64	64	48
United States				
Japan	24	24	7	7
World's total	981	770	193	155

SULPHUR. — The Italian production of raw sulphur during the first ha of 1917 is officially estimated at 100 240 metric tons, against 269 374 an 558 107 tons respectively for the complete years 1916 and 1915.

Almost the whole of the sulphur produced in the United States a present comes from deposits in Louisiana and Texas, but deposits that hav been, or might be productive, are known in Wyoming, Nevada, Utah, California Colorado, Oregon and Alaska.

The production of 1915 and 1916 has not been officially estimate Some authorities on the question reckon that the United States have consume about 900 000 tons of sulphur, as compared with 300 000 tons in 1913. It is expected that the demand in the States will attain 1 200 000 tons in 191 and may probably grow to 1.600.000 tons in 1918 if the war continues.

The subjoined table contains the numerical data of importance take from the summary made with regard to this product by the Institute o Agriculture:

Sulphur	1916	1915	1914	1913
	thousands of metric tons			
Spain	11	10	8	7
Italy	269	358	378	386
United States	—	(a) 381	381	317
Japan	93	61	60	49
Other countries (b)	50	50	50	50

(a) Louisiana only. — (b) In round numbers.

SULPHATE OF COPPER. — Subjoined are the items of information publishe by the Institute:

Sulphate of copper	1916	1915	1914	1913
	thousands of metric tons			
Spain	8	1	0	0
France	27	16	21	26
Great Britain	39	66	69	77
Italy	48	41	31	44
United States	(a) 6	19	14	25

(a) Production of the *American Smelting and Refining Company* only.

II. International trade.

Owing to the prolongation of the war the extent of international trade in the products under review is considerably diminishing, with the exceptions of exports of nitrate of soda from Chili, and of occasional business in other articles. This reduction is consequent on the scarcity of tonnage and on the resulting very high freights, together with the restrictions and prohibitions of export imposed by the Governments, owing to the more or less important use of these products in manufacture of munitions.

As regards the United States, the nitrate trade continues very active, whilst for European destinations there is a decided tendency towards decrease.

III. Wholesale prices.

Prices for fertilisers have on the whole continued to advance during the first eight months of 1917 and for some products the rise has been quite as pronounced as in the same period of 1916. The enhancement in sulphur has been quite a considerable one.

Quotations on the more important markets for the chief products have been as follows:

	Average of 1916	Average of January 1917	Average of July 1917	Average of the first half of 1917
	in gold francs per quintal			
Chlorate of potash:				
London	138	140	149	154
New York	207	224	193	218
Sulphate of potash:				
London	146	147	161	162
New York	163	150	150	150
Nitrate of soda:				
Valencia	49	57	67	61
Paris	49	49	67	57
Genoa	44	58	104	71
Liverpool	44	59	62	57
New York	37	38	49	43
Sulphate of ammonia:				
Valencia	57	79	134	110
Paris	51	56	77	64
Genoa	51	48	83	52
Hull	43	46	53	48
New York	43	53	71	61
Raw sulphur:				
London	23	29	31	35
Licata (Sicily)	13	18	26	20
New York	17	18	23	22
Sulphate of copper:				
Valencia	190	158	183	169
French Atlantic ports	127	138	200	159
London	130	161	154	150
Genoa	144	n. q.	103	103
New York	187	146	114	120

Note: n. q. = no quotation.

In addition to the above mentioned data, which summarise only a small portion of the review made by the International Institute of Agriculture of Rome, there will be found in that review some interesting particulars as to sulphate of copper in France, and the consumption of fertilisers in France and in the United States, etc.

15. – **The Fertilising Value of some Household Wastes.** — BROWNING, P. E., in *Journal of Industrial and Engineering Chemistry*, Vol. 9, No. 11, p. 1043. Easton, Pa., November, 1917.

This paper gives the analyses of the ash of certain household wastes, carried out with a view to establish the results which may be obtained by burning in an improvised incinerator under ordinary household conditions.

Ash	K_2O per cent.	P_2O_5 per cent.	Ash	K_2O per cent.	P_2O_5 per cent.
Banana stalk	49.40	2.34	Cucumber skins	27.20	11.28
Banana skins	41.76	3.25	Stringbean strings and stems	18.09	4.99
Grape fruit skins	30.60	3.58	Tea leaf ash	0.44	1.60
Orange skins	27.00	2.90	Coffee beans (dried)	0.67	0.36
Lemon skins	31.00	6.36	Lamb-chop bone ash	1.62	26.60
Apple skins	11.74	3.08	Burned egg shells	0.29	0.13
Cantaloupe rinds	12.21	0.77	Tobacco	16.81	2.57
Raw white potato skin	27.50	5.18	Peanut shell ash	6.45	1.23
Boiled sweet potato skin	13.89	3.29	Peach stones	6.04	3.25
Pea pods	9.00	1.79	Peach skins	30.76	6.31

16. – **Fertilising Value of Waste Cabbage Leaves, in Holland.** — See No. 65 of this *Review*.

17. – **Fertilising Value of Cider Residues.** — See No. 68 of this *Review*.

18. – **Awards for the Location of Workable Phosphatic Deposits, in Germany.** — I. Bereitstellung von Fundprämien fur abbauwürdige Phosphatlager, in *Kunstdünger- Futtermittel- Leim- und Oel- und Fett-Zeitung*, Year 11, No. 16, p. 109. Berlin, 1917. — II. Bereitstellung von Fundprämien für abbauwürdige Phosphatlager, Veröffentlichungen des Preussischen Landwirtschaftsministeriums. *Ibid.*, No. 9, p. 127.

The phosphatic manure requirements of German agriculture were satisfied in peace times chiefly by superphosphates prepared with imported phosphates and by basic slag. The production of the latter has diminished a little during the war, and the imported phosphates can only be replaced in part by those from northern France and Belgium and by the re-opening of the Lahn (Nassau) mines (1), carried out by the War Society for Phosphates.

By the use of new methods it is now possible to work phosphatic rocks which previously were not utilisable for the production of fertilisers. Nevertheless, in order to maintain German agricultural production at a normal level, a larger quantity of phosphatic manure is required. In order to obtain this, awards to the amount of 100 000 *Mark* (1 *Mark* = 11 $^3/_4$ *d. at par*) have been offered for the location of new phosphate deposits and for their study, either within the German Empire or in the occupied territories in the east. The funds for these awards have been supplied by the Prussian State, the German Agricultural Society, the Union of Manufacturers of Chemical Manures, and the "Rhenania" (Aachen) Factory of Chemical Products. All information with regard to new deposits must be addressed to the Prussian Department of Agriculture, Office for Raw Materials. If the deposits are worked the informant will receive a bonus per ton of mineral extracted.

(1) See BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES, *Production and Consumption of Fertilizers in the World*, 2nd. ed., p. 9. Rome, 1911. (*Ed.*)

19 - **The Collection of Kelp in the United States for Potash Production.** — *American Machinist*, Vol. 47, No. 14, pp. 599-600, figs. 2. London, November 17, 1917.

Various companies are now gathering kelp for potash production, along the Pacific coast from Los Angeles to San Diego.

The potash produced costs more than that imported before the war from Germany. It remains to be seen whether the cost of production can be sufficiently reduced.

The foliage of the kelp floating on the surface of the water is gathered as it contains most potash. Large barges are used, one end being fitted with a conveyor equipped with knives like those of mowing machines. These knives vary from 10 to 16 ft. in length, and are of triangular shape. The conveyors are sometimes fitted with side knives to clear the kelp completely and make it easier for it to be moved by the conveyor. These knives, as well as the conveyors, are run by chain from a small gasoline engine in the barge.

The conveyor is lowered into the water to the desired depth, usually about 4 to 6 feet. Below this the kelp contains less potash, and it is also more difficult to handle. The barges are usually towed, though some are motor driven. The power required is very small as they only move at the rate of about 2 miles an hour. The barges cost about $65 000 each and vary greatly in capacity; some can gather 60 tons an hour while others only handle 300 tons in 24 hours. In calm weather the kelp is gathered at a distance of 2 or 3 miles from shore. About 3 crops a year are gathered.

The kelp contains about seven-eighths water and 21 to 22 tons of wet kelp give 1 ton of ash. The ash yields about 32 % of potash, or about 4 % of the weight of the wet kelp.

20 - **20 % Potassium Salt as a Fertiliser.** — VAN STORK, D. (Rijkslandbouwproefstation te Maastricht), in *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstations*, No. XX, pp. 35-42. The Hague, 1917.

Since 1910 the 40 % potassium salt for fertilisers, largely used in Holland, was imported from Germany.

After the war the importation was reduced to limited quantities of a 20 % salt. The analysis of typical samples of this product showed the 20 % salt, like the 40 % one, to be composed chiefly of potassium and sodium chloride with, for example, as much as 50 % of carnalite (double chloride of potassium and magnesium), or large quantities of kieserite (magnesium sulphate).

21 - **The Effect of Different Methods of Inoculation on the Yield and Protein Content of Alfalfa and Sweet Clover.** — ARNY, A. C. and TATCHER, R. W., in the *Journal of the American Society of Agronomy*, Vol. 7, p. 172-185; Vol. 9, p. 127-137. Washington, 1915, and 1917.

The experiments described were carried out during the season 1914 and 1915 in order to study the effect of different methods of inoculation on the yield and chemical composition of alfalfa and sweet clover, during consecutive seasons in three different plots.

The data collected refer to: — 1) the weight and protein content of three successive cuttings, during each of the two years, on 14 plots of in-

oculated alfalfa and 9 uninoculated control plots ; 2) the weight and protein content of one year's harvest on 2 plots of inoculated sweet clover, and 3 uninoculated plots ; 3) analyses of the aerial parts and roots of 2 consecutive alfalfa harvests and 2 consecutive sweet clover harvests on 3 inoculated and uninoculated plots of 1 square yard respectively.

The results show that, in the experimental plots, inoculation at the time the grain is forming causes a marked increase, at the first harvest, in the unit yields in dry matter and in protein content as compared with the results obtained on the uninoculated plots. During the following season (2nd. harvest), the differences are less marked, and disappear almost completely the following year owing to the rapid propagation of the bacteria inoculated on the uninoculated plots.

The inoculation of either alfalfa or sweet clover with soil from plots on which both had done well had a similar effect ; and, from an experimental point of view, better results were obtained with the inoculated soil than with the commercial cultures used. Liming with 5 ½ bushels of crushed lime per acre during the formation of the grain slightly increased the effects of inoculation.

Amongst these effects was also considered that of giving the plants a greater capacity for utilising the mineral fertilising elements of the soil in so far as an increased harvest causes a greater loss of potash, phosphoric acid and lime from the soil. Another effect of inoculation is that the plants inoculated can form a slightly larger quantity of dry matter with a given quantity of mineral fertilising elements.

22 – ***Isopyrum fumarioides*, A New Hydrocyanic Acid-Containing Plant.** – MIRANDE, MARCEL, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV No. 21, pp. 717-718. Paris, November 19, 1917.

In *Isopyrum fumarioides* L., a native of Siberia, grown in the Lantaret Alpine Garden, was found a substance which, under the influence of an enzyme, acting in a similar way to emulsine, and also contained in the plant, decomposes giving, among other products, hydrocyanic acid. An estimation by the method of FORDOS and GELIS, in the month of August, showed 100 gm. of fresh plants in full flower and even almost in fruit, to contain 0.249 gm. of hydrocyanic acid. This result places the plants among those most rich in cyanic products.

In a previous note (*Comptes rendus de la Société de Biologie*, November 22, 1913), the author drew attention to the presence of hydrocyanic acid in *Isopyrum thalictroides* L., which contained 0.042 gm. per 100 gm. of fresh plant.

23 – **The Influence of Aeration of the Nutrient Solution in Water Culture Experiments, Remarks on the Water Culture Method.** — STILES, W. and JÖRGENSEN, I. in *New Phytologist*, Vol. XVI, Nos. 8-9, pp. 181-197, bibliography of 11 works. London Oct.-Nov., 1917.

The writers emphasize the complexity of problems of water cultures and endeavour to illustrate it especially in relation to aeration, having obtained similar results of those of HALL, BRENCHLEY and UNDERWOOD in

elation to the increase in growth of barley resulting from aeration (1); on the other hand with buckwheat a result was obtained similar to that of REE, who found no benefit to result from aeration. It does not follow, however, that the same result would be obtained under all conditions of experiment. It is very likely that there are conditions in which aeration would produce no effect on the rate of growth of barley, or which would increase the rate of growth of buckwheat. The writers show also how different conditions bring about different increases in the rate of growth as a result of aeration.

There is at present no explanation why, under the conditions of the reported experiments, aeration should increase the rate of growth of some species and not of others; whether it is to be correlated with oxygen supply, removal of carbon dioxide, removal of diffusion gradients, or change in solubility conditions or other causes. There seems no doubt, however, that water culture conditions react in a different manner on different species.

It must be emphasized that a great deal of work must be done on the physical chemistry of water culture solutions before work can be done with necessary definiteness. Particularly investigation must be extended on dynamical principles as is clearly indicated from the investigations of PANTANELLI (2).

Further it is obviously desirable to work towards getting some more explicit principle which will take into account the co-operation of the various activities of the plant. It seems clear that at present neither the law of the minimum nor the principle of limiting factors as employed by BLACKMAN in regard to the sub-aerial part of the plant are expressions of our present knowledge of the life of the plant as a whole.

The detachment between plant physiology and agriculture might be removed if a working principle in regard to the physiological relations of plant processes were evolved which embodied the activities of both sub-aerial and subterranean parts of the plant. This is highly desirable, but it must be admitted that it seems remote at present.

1 – **Researches on the Pigmentation of the Ear of Wheat, in Russia.** — ЛЕВИЦКІЙ СТ., (LEVITZKI, ST.), in *Журналъ по опытной Агрономіи* (*Review of Experimental Agronomy*), Vol. XVIII, Part 1, pp. 46-61. Petrograd, 1917.

There are 2 pigments which produce the colour of the glumes and other parts of the ear, namely, carotine producing *red*, and another pigment, of unknown composition, producing *black*. Ears wholly lacking pigment are of a clear straw colour and are described as *white*.

In south east Russia, *white* wheats give better yields, as regards quantity and quality, than the black or red wheats. This fact is thus explained by the writer: in dry climates the leaves dry and die even before maturity is attained, and the function of assimilation, already reduced, is then carried on by the glumes and other green parts of the plant. Now, the red or black pigment, which develops by displacing and replacing the chloro-

(1) See *B.* Jan. 1914, No. 12. (*Ed.*). (2) PANTANELLI, E., Über Jonenaufnahme. *Jahrbuch wiss. Botanik* (Pfeiffer-Festschrift), pp. 680-733. 1915. (*Author*)

phyll granules, causes a still further decrease in assimilation, which results in incomplete development of the caryopses. This fact has led the plant-breeders at the Besen agricultural experiment Station to confine their attention solely to these wheats with *white* ears.

In order to study this interesting phenomenon and to ascertain the conditions, favourable or otherwise, for the accumulation of pigment in the tissues of Gramineae, the writer carried out a series of pot-culture and field experiments, using the following wheats: —

SOFT WHEATS. — 2 pure lines with *red* ears: *Triticum ferrugineum* and *T. milturum* 2 pure lines with *white* ears: *T. erythrospermum* and *T. lutescens*.

HARD WHEATS. — 1 type with *red* ears: *T. hordeiforme*; 2 types with *black* ears: *T. coerulescens* and *T. abyssinicum*.

It was to be expected that the presence of pigment, by limiting assimilation, would retard the various phases of development and prolong the whole vegetative period. This was actually observed, as is shown by the phenological data given in the following Table:

Phenological data regarding the various types of wheat employed.

	Types	Sowing	Sprouting	Beginning of earing	Full earing	Beginning of flowering	In full flower	Harvest
	Soft wheats:							
Reds Whites	*erythrospermum*	14 IV	20 IV	8 VI	10 VI	11 VI	15 VI	25 VII
Reds Whites	*lutescens*	*id.*	*id.*	7 VI	10 VI	11 VI	12 VI	*id.*
Reds Whites	*ferrugineum*	*id.*	*id.*	9 VI	12 VI	15 VI	15 IV	*id.*
Reds Whites	*milturum*	*id.*	*id.*	10 VI	12 VI	15 VI	17 VI	*id.*
	Hard wheats:							
	Red: *hordeiforme*	*id.*	21 IV	8 VI	11 VI	16 VI	18 VI	1 VIII
Blacks	*coerulescens*	*id.*	*id.*	9 VI	12 VI	16 VI	18 VI	1 VIII
Blacks	*abyssinicum*	*id.*	*id.*	3 VI	7 VI	9 VI	11 VI	19 VII

Although a damp and even rainy season had considerably hastened the development of all the varieties, including the pigmented ones, the characteristic differences between the different types of wheat remained, however, well marked. Compared with the *white* eared wheats, the beardless *red* wheat eared 3 days and flowered 4 days later; the *red* bearded wheats were 1 and 4 days later respectively. These data, obtained by field experiments were confirmed by the results of pot-culture experiments.

As regards the quantity and quality of the grain harvested, the two series of experiments, both field and pot-culture, showed the superiority of the *white* wheats over the *red* and *black* types.

Those plants and ears, or parts of ears, that faced south-west, pigmented more quickly than plants or ears with a different orientation. Thus the phenomenon of pigmentation seems closely connected with the light, and

n fact, the duration and intensity of the insolation is at its maximum when he sun is to the south-west. This explanation is confirmed by the results f pot-culture experiments with screens protecting the plants from the sun's ays. These results may be thus summarised :

1) The longer the plants are shaded, the less intense is the pigmentation.

2) The effect of the screen is more marked if the plants are shaded be- ore flowering ; after that, the effect of the screen (negative effect) is more nd more attenuated as the plants approach maturity.

3) The effect noticeable on the glume is repeated with the caryopsis, specially with the type *T. abyssinicum* which, when subjected to prolong- d shading, finally loses the violet tint characteristic of its seeds.

5 - **The Viability of the Seeds of *Raphanus sativus* L. as Affected by High Temperatures and Water Content** (1). — WAGGONER, H. D., in the *American Journal of Botany*, Vol. IV, No. 5, pp. 299-313, 1 fig., bibliographical index. Lancaster, Pa., May, 1917.

The results of a series of experiments undertaken for the purpose of letermining the definite relation between the water content of seeds exposed o high temperatures and their viability. Seeds of 3 varieties of radish Icicle, Black Spanish Winter, and Crystal Forcing) were used, with an nitial water content of from 4 to 71 per cent. In order to heat the seeds, he writer used 3 different methods: 1) in water; 2) in 300 cc. Florence flasks laced in a wire cage and submerged in a water-bath; 3) in an oven. ength of exposure, 30 minutes; temperature, from 50° to 125° C. The eeds were then germinated on plaster of Paris blocks kept in a dark oom at about 23° C. (100 seeds were used for each test). For one fort- ight, the number of seeds that had germinated every day was observed.

The general resistance to high temperatures of the 3 varieties studied s very similar, therefore it is sufficient to give the data for Icicle (see Ta- le II). An examination of the tables shows that there is a definite rela- ion between the initial water content of seeds and their resistance. Seeds f an initial water content of 71 per cent., 50 per cent. and 45 per cent., re killed off at 60° C. The germinating capacity of the seeds increases vith the decrease in the water content and the death point of the sample s raised. As the water content is decreased from 45 to 30 per cent., the ethal temperature shifts from 60° C to 65° C. Air-dried seeds give normal ermination after treating at 75° C. and are killed between 95° C. and 100° C. amples dried until only 4 per cent. of water is present, give a normal ermination at 100° C., and are killed between 123° C. and 125° C.

In the check, the maximum daily per cent. of germination (45 per cent.) ccurred on the 2nd. day, while of the treated seeds, those which had been xposed to temperatures below the critical temperature, gave highest per- entages on the 3rd., or 4th. day (see Table II). The retardation becomes reater as the injury due to the treatment becomes more marked.

In determining the lethal temperatures for seeds of similar kinds, revious investigators had obtained very different results. This is probably

(1) On the subject of the effect of high temperatures on the vitality of seeds, see also . June, 1917, No. 533 and *R.* September 1917, No. 891. (*Ed*)

due to the fact that, in these experiments, no attention was paid to the initial water content which, as has just been shown, causes the lethal temperature to vary within very large limits. The data obtained by the investigator depended upon the method used for heating the seeds. With an initial water content of 19 per cent,, the lethal temperature was 65° C. for seeds heated in water; 85° C. for those heated in flasks; 105° C. for the seeds heated in the oven (See Table III).

Seeds heated in water absorb, during the experiment, a considerable amount of moisture, as is shown by the increase in weight. Seeds heated in flasks lose in weight for the first 10 minutes, after which the weight remains constant; seeds heated in the oven lose weight throughout the duration of the experiment, and it is owing to this loss of water, that they acquire greater powers of resisting the effect of high temperatures.

TABLE I. — *Germination Percentages in the Icicle variety.*

Initial Water Content	Temperatures																Unheated Seed
	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	
	Germination Percentages:																
71 %	80	45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	87
50 %	83	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	88
45 %	84	69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	87
38 %	82	72	14	—	—	—	—	—	—	—	—	—	—	—	—	—	89
30 %	—	74	25	—	—	—	—	—	—	—	—	—	—	—	—	—	90
23 %	—	74	38	1	—	—	—	—	—	—	—	—	—	—	—	—	90
18 %	—	78	66	38	11	—	—	6	—	—	—	—	—	—	—	—	88
14 %	—	85	74	69	63	26	18	6	—	—	—	—	—	—	—	—	80
9 %	—	88	82	85	74	54	36	15	10	—	—	—	—	—	—	—	90
4 %	—	—	86	91	90	61	82	79	76	40	—	—	—	—	—	—	89
2.3 %	—	—	—	—	—	80	88	87	99	87	80	72	57	5	—	—	88
1.3 %	—	—	—	—	—	—	—	90	89	88	82	73	67	32	4	—	89
0.8 %	—	—	—	—	—	—	—	—	—	89	88	85	76	62	32	—	80
0.4 %	—	—	—	—	—	—	—	—	—	—	80	86	78	64	28	14	90

TABLE II. — *Retardation in Germination caused by Varying Water Content when Heating at 80° C. for 30 minutes.*

	Initial Water Content				Unheated Seeds
	4 %	9 %	14 %	18 %	
	Germination Percentages:				
1st day	6 %	0.6 %	0 %	0 %	30 %
2nd day	21	5.4	0	0	45
3rd day	35	17.0	7.4	0	14
4th day	17	24.2	11.0	0	3
5th day	3	10.0	6.0	0	2
6th day	1	3.6	2.2	0	1
7th day	0	0	0.4	0	0
Total Percentage	83 %	68.8 %	27.0 %	0 %	90 %

TABLE III — *The Effect of Different Methods of Heating Upon the Germination of Seeds.*

	Temperatures												
	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°
	Germination Percentages:												
an heated in water	88	80	58	2	0	0	—	—	—	—	—	—	—
an heated in flasks	—	89	89	81	60	18	9	0	0	—	—	—	—
en heated in oven	—	—	—	—	—	—	89	88	84	76	60	6	0
cks, untreated	88	90	89	88	89	91	90	90	89	88	90	90	89

– The Action of Overhead Electric Discharges on Oats and Clover. — See No. 10 of this *Review*.

Reversible Transformability of Allelomorphs in Rice in Japan. — TERAO, H. (Imperial Agricultural Experiment Station, Tokyo, Japan), in *The American Naturalist*, Vol. II, No. 611, pp. 690-698, VII Tables. New York, 1917.

In certain pedigree cultures of the rice plant, at the above-mentioned ation, the writer observed in 1912, families containing a number of rile plants besides ordinary fertile plants. The former may be divided to 3 groups:

1) Forms yielding no seed.
2) Forms yielding a small number of seeds.
3) Mosaic forms with higher fertility.

These anomalies occurred in 2 families, *A* and *B*, which were derived m 2 plants each belonging to a different variety of rice. Tables I and summarise the observations made on these families in 1912 and 1913.

From these observations it would appear that sterility, **S**, behaves as imple recessive to fertility, **F**, which is a dominant. **F** and **S** form a pair allelomorphs, and the seeds produced, by partial fertility, by the sterile nts, give rise to families composed of fertile and sterile individuals in the ndelian ratio 3 : 1.

TABLE I. — *The Segregating Families A and B, in* 1912.

Family	Number of fertile plants	Number of sterile plants	Total number of plants	Percentage of sterile plants	Partial fertility of sterile plants: Ratio 3 : 1 Fertile individuals, dominants	Sterile individuals, recessives	Total number of spikelets	Fertile spikelets: Number	Fertile spikelets: Percentage
	30	13	49	26.53 %	2.94	1.06	9 000	2	0.02 %
	105	25	130	19.23 %	3.23	0.77	14 941	434	2.90 %

TABLE II. — *The Families Derived from the Families A and B in* 1913.

1) *The Progeny of the Fertile Plants.*

Families in 1912	Number of families in 1913			Ratio 1 : 2		Composition of partially fertile families in 1913			
	Composed of uniformly fertile plants	Composed of fertile plants and of sterile plants	Total	Uniformly fertile plants	Partially fertile plants	Number of fertile plants	Number of sterile plants	Total number of plants	Percentage of sterile plants
A	10	22	32	0.94	2.06	1.068	346	1.414	24.46
B	41	64	105	1.17	1.83	4 874	1 301	6 175	21.06

2) *The Progeny of the seeds on the sterile plants.*

Families in 1912	Number of families in 1913	Composition of families in 1913			
		Number of fertile plants	Number of sterile plants	Total number of plants	Percentage of sterile plant
A	2	2	0	2	0.00 "
B	24	401	115	516	22.29 "

In family *A*, which shows an exceedingly slight fertility (0.02 per cent. of sterile plants, the segregation ratio in the offspring derived from fertile individuals, in 1913, is quite close to expectation. On the other hand, in family *B*, which shows a considerably higher grade of partial fecundity of sterile plants (2.90 per cent.), the progeny of the fertile (dominant) individuals exhibit considerable deviations from the expected segregation ratio, the fertile plants being more numerous.

The writer explains this phenomenon as follows: the dominant and recessive types concerned are assumed to be transformed by certain unknown causes into the other allelomorph. In the cases observed by the writer, the recessive allelomorph **S**, which appeared in 1912 in families *A* and *B* may have originated in the preceding generation (1911) by the transformation of the dominant allelomorph, **F**. This recessive state however, of the hereditary substance has a tendency to revert to the original dominant state, and this reversion is especially likely to occur in the vegetative cells. Consequently, in recessive homozygotes, **SS**, the reversion will generally produce heterozygotic cells **FS** or **SF**, capable of being changed into homozygotic dominants **FF**. The heterozygotic cells thus formed will give rise to partial fertility in otherwise sterile plants, and cause the excess in the proportion of dominant individuals in plants arising from the seeds produced by the partial fertility of the sterile plants of family *B*. Finally, it may be assumed that, between families *A* and *B*, there exists a difference in the reverting tendency of the recessive and dominant characters; this tendency would be strongest

n family *B*, where the number of sterile plants in the process of egregation is, on an average, 4 per cent. less than was theoretically expected.

There are also cases where the transformation of the allelomorphs takes lace in the reverse direction: from dominants to recessives. Thus, in the escendants of families which had proved to be constantly fertile, the ccurence of partially sterile families was observed. On the other hand, constant tendency of the dominant allelomorph to be transformed into he recessive allelomorph was observed in certain strains; thus, in 1913, in ertain partially sterile families there was a particularly high excess of re- essive individuals.

The fertile spikelets of sterile plants are generally scattered at random ver the panicle, and each fertile spikelet may be regarded as representing separate case of reversion. In mosaic forms, which show higher fertility nd are of rare occurrence, the reversion may have taken place in earlier tages of plant development, affecting more or less extensive groups of ells which gave rise to the fertile portions, such as groups of spikelets, ull a panicle, or even a whole panicle, each group, however, constituting single case of reversion. Consequently, when the count of fertile spikelets s made with only the first type of sterile plants, a more correct value for he frequency of reversion may be obtained. The result of such a count on 02 panicles containing 93 635 spikelets is 1858 fertile spikelets *i. e.* 1.98 er cent. of the total number of spikelets.

Conclusions. — The allelomorphs concerned in this investigation are rob ably subject to reversible transformations, of which the direction and requency may be practically constant in a certain strain, but may be ifferent in different strains.

As regards the conception of dominance and recessiveness, Bateson's heory of "presence and absence of factors" is sometimes understood in he sense that the dominant allelomorph is regarded as due to the real presence of an hereditary material unit which is absent in the recessive allelomorph. Such a conception is not in full accordance with the idea of the eversible transformability of allelomorphs as described in this investigation.

This reversible transformability of allelomorphs is better explained y supposing that the dominant and recessive allelomorphs represent 2 ternative conditions, or phases, of a single hereditary substance somehat resembling the chemical conception of polymerization.

* — **Selection of Sorgum in Queensland, Australia.** — Brooks, C. B., in *Queensland Agricultural Journal*, Vol. VIII, Pt. 4, pp. 194-197 + 1 plate. Brisbane, October, 1917.

Many varieties of both fodder and grain sorghums are cultivated in ueensland as they are well suited to this country on account of their restance to drought.

Results are given of selection experiments designed to increase the ain yield, results which exceeded all expectation. Thus, for the fodder rieties, the grain production rose from 25.6 bushels per acre in 1916 to bushels in 1917, and, for the grain varieties, from 50.8 bushels to 70.2

bushels. The average weights of the ears of the different varieties fo 1916 and 1917 are given in the appended table :

Weight of the ears of the different varieties of sorghum in 1916 *and* 1917.

Variety	1916	1917	Heaviest head in 1917 selectio
	Oz.	Oz.	Oz.
Crossbred, No. 1 Selection	7.0	11.8	13.0
» No. 2 Selection	—	10.0	10.5
Giant Honduras	—	6.8	8.5
Cream Milo	4.8	5.9	7.5
Feterita (Sudan Dhoura)	4.0	5.6	6.8
Planters' Friend	3.0	5.1	6.8
Standard Milo	4.2	4.9	5.5
B. H. Kaffir	3.4	4.7	6.8
Dwarf Milo	4.2	4.9	5.0
Shantung Dwarf	3.2	3.6	4.0
Saccharatum	2.5	2.9	4.3
Amber	1.2	1.8	2.0

The crossbreds show an absolute superiority in the weight of the ea which gives good promise for the final results of the selection work. Ce tain undesirable characters, such as astringent grain and late maturing will be eliminated later by suitable crossings.

It should be noted that the open seed varieties are less liable to attac from the maize caterpillar than the compact headed ones.

29 – **Researches on the 35 Factors Determining the Various Characters of the Genu *Pisum*, in the United States.**—WHITE, ORLAND E. (Curator of Plant Breeding, Brooklyn Botanic Garden), in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 166-1 IV + 27 tables, bibliographical index of 39 publications. Washington, 1917.

Experimental researches on the genetic factors of *Pisum* carried ou by a method of rigorous investigation at the Brooklyn Botanic Garde New York, and completed by a critical examination of the works and ex periments of previous writers.

The article in question is divided into 4 parts :

I. — An analytic list of the 35 factors hitherto isolated and studied.
II. — The effect of external agents upon the expression of these factors.
III. — Factors which are transmitted independently of one another.
IV. — Linkage of factors.

I. — GENETIC OR DETERMINING FACTORS. — There are 35 genetic factor which suffice to explain all the specific differences between the numerou species and varieties of the genus *Pisum*. These factors influence their habit of growth; time of flowering; colour of stems, leaves and flowers colour of the cotyledons and of the seed-coats; colour and character of th pods and seeds.

1) *Mode of growth :* **T** = tall, robust plants, large number of internodes (**Le**) = long internodes ; (**Fa**) = axillary flowers, round stems, regula

phyllotaxy; (**Fn**) = 1 or 2 flowers per peduncle; (**Tl**) = leaves with tendrils; (**Lf**) = late flowering; (**Ef**) = early flowering.

2) *Colour of flowers :* — **A** = salmon-pink or rose (**B** gives purple colour when combined with **A**).

3) *Colour of stem and leaves :* — The factors **C** and **D** give red colour to leaf axil and stem (with the addition of **A**) and a purple colour with the addition of **B**; the factor **O** produces green foliage, stems and pods; (**Bl**) coupled with **W** gives a glaucous tint.

4) *Colour of cotyledons :* — **G**, green cotyledon pigment, is made paler by presence of **I**.

5) *Colour of seed-coats :* (**Gc**) [**A**] produces yellowish green to greyish-brown seed coat, which colour is brightened or inhibited by **H** and becomes dark-brown in the presence of **I**; **U** = dark self-coloured seed coat; (**Pl**) = black-eyed pattern; **E** (**A**), with **F** and **B**, gives purple dottings which, in the absence of **B**, gives reddish dots; **W** = brown or maple mottling; **N** = violet eyes.

6) *Colour of pods :* — $P_1 + P_2$ gives purple pods; (**Gp**) = green.

7) *Seed characters :* — **R** produces smooth round seeds with simple, oval starch grains, low water content and excellent powers of germination under unfavourable weather conditions; L_1 (**A**) + L_2 give indent peas; **V** produces pods with separate, or free seeds.

8) *Pod characters:* — (**Bt**) = pods with blunt apex; **P** + **V** gives parchmented, smooth pods, which are not edible.

II — MODIFICATION OF THE EXPRESSION OF PISUM FACTORS BY EXTERNAL AGENTS. — The absence of (**Fa**) brings about intense fasciation of the stems, but this may be produced, even in the presence of (**Fa**), by damp weather and lack of sufficient sunlight.

Peas may be classified into 3 general types as regards height.

(1) dwarfs, with from 8 to 15 short internodes;
(2) half-dwarfs, with 10 to 18 long internodes, or 20 to 30 short ones;
(3) tall, with 35 to 60 well-developed internodes.

These differences depend upon 2 factors (**Le**) and **T**, and they are often modified by disease and high temperature, etc., which produce cases of dwarfs, even in the presence of the 2 factors (**Le**) and **T**.

The expression of the factor **O** may be suppressed by lack of sufficient salts (especially potash) in the soil. In this case, the aerial parts are of a sickly yellow colour.

Prolonged damp or rainy weather, even in the presence of the 2 factors **E** and **B**, change the purple colour to pink, or in extreme cases, to white.

The anthocyanin pigment of the seed-coat pattern, brought about by the factors **E** and **F**, is soluble in water and may be washed out in rainy weather, even in the presence of **E** and **F**.

Under greenhouse conditions, where the temperature and humidity are constant, the above-mentioned fluctuations do not occur, which allows of the different genetic factors being more distinctly individualised. Once the presence of a certain factor has been determined in a given pure line,

the absence or hindrance of the expression of this factor may be attribu ed to external agents.

III. — THE NUMBER OF INDEPENDENT FACTORS. — The cytologi al studies hitherto made show that there are 7 pairs of chromosomes i the species of *Pisum* investigated. According to the chromosome theo each determinant is localised at a single fixed point of a chromosome whic is always the same.

Therefore, in the case of the genus *Pisum*, the number of characte or groups of characters, which are wholly independent of one another, i the processes of separation and recombination, cannot exceed 7.

The writer carefully analyses the F_2 ratios from crosses involvin the presence and absence of 8 factors: — **A**; **B**; **(Fa)**; **I**; **(Le)**; **G**; **R**; **(Tl)**, of which **R** and **(Tl)** are linked, that is to say, localised in the same chrom some. Each factor has been tested out in crosses involving *all its po sible combinations* with the other 6. Data involving many thousand i generation progeny, indicate that the number of independent factors 7, namely: **A**; **B**; **(Fa)**; **I**; **(Le)**; **G**; **R**.

IV. — LINKAGE IN PISUM. — Two or more factors contained in the sam chromosome are naturally united in such a manner that one character always associated with the other corresponding character.

The writer has collected data concerning the following linked group

1) **Bl S** = pods with seeds separate or free; glaucous foliage stems and pods wi 'bloom".

2) **A (Lf)** = Salmon - pink or rose - coloured flowers; late flowering.

3) **GO** = Green cotyledons; green (non-glaucous) stems, leaves and pods.

4) **A C E Gc L_t** = in this group, the factors are so closely associated, that they m be considered as the expression of one single factor **A**.

In the genus *Pisum* the length of the chromosomes facilitates th phenomenon of crossing-over (1) and renders still more difficult th determination of independent characters, and of groups of characte based on the chromosome theory.

The writer has, however, been able to overcome this difficulty by mea of multiplying the control experiments, so that the data obtained do n only permit of the determination of the gametic formula of any specie variety, or kind, of *Pisum*, but also make it possible to predict the resul of any crossing.

(1) MORGAN and his collaborators have studied the interesting phenomenon of the recipro exchange of elements between 2 chromosomes, which phenomenon is called "crossing ove Each chromosome may be regarded as the sum of a large number of linear segments, each which would represent a genetic factor. If, for instance, in the case of 2 chromosomes equal length and composed of an equal number of segments, these segments on touching o other should be exchanged, the phenomenon of "crossing over" would be produced and occ the more frequently the longer the chromosome and the less completely the elements of a seri are united. Cf. MULLER H., the Mechanism of Crossing-Over, in *The American Naturali* Vol. 50, No. 592, pp. 193-221, 5 figs.; No. 593, pp. 284-305, 4 figs.; No. 594, pp. 350-366; No. 5 pp. 421-434. 4 figs. Lancaster, Pa., 1916. (*Ed.*)

- The Indirect Effects of Certain Selections in Breeding Indian Corn. — RIETZ, H. L. (Professor of Mathematical Statistics and Statistician) and SMITH L. H. (Chief in Plant Breeding, Illinois Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 105-146, 5 Tables, 24 Diagrams, Washington, 1917.

As the result of individual selection experiments extending over a nsiderable period, the Illinois Agricultural Experiment Station has suc-ded in creating from the same stock, 4 strains of maize which differ in ir protein and oil content.

1) Maize with high protein content ("high-protein strain")
2) Maize with low protein content ("low-protein strain")
3) Maize rich in oil ("high-oil strain")
4) Maize poor in oil ("low-oil strain")

The article analysed gives the results of a statistico-experimental ıdy undertaken in order to determine if chemical selection has indirect ects of an anatomical nature, or in other words, if the 4 above-mentioned ains differ, not only in chemical composition, but also in other constant ometrical values. The physical characters treated of are: 1) length of rs; 2) circumference of ears; 3) weight of cars; 4) number of rows of rnels on cars. The physical characters determined in 1905 (see Table allow of real specific differences being established, but the observations one year are not sufficient, for it may only be a question of fluctuations, at is to say, of differences and ratios that are not fixed and constant, but ich vary from one year to another. To avoid this difficulty, the writers ntinued their work of selection, determination and classification for 11 cessive generations of maize (1905-1915). The following is a summary of e most important results which they obtained.

LENGTH OF EAR. — In 1905, the length of ear was significantly differ-t in the 4 strains. The smallest difference that existed was 0.27 ± 0.056; is is about 5 times the probable error. We have to do here, therefore, ith a well-defined character which persisted throughout the observation riod in spite of different conditions of soil and climate.

CIRCUMFERENCE OF THE EAR. — The strains differed from one another a greater extent and more constantly in the circumference of the cars an in the length. The types rich in protein had, as a rule, the most slender rs, while thicker ears were found in the strains which had a low oil con-nt. The difference between the low-oil and the low-protein strains, al-ough slight, remained constant throughout the period of observation.

WEIGHT OF EARS. — As in the two preceding cases, the high-protein d the high-oil strains had lighter (*i. e.*, shorter and more slender) ears an the low-protein or low-oil. This difference remained constant during e whole period of observation.

NUMBER OF ROWS OF KERNELS ON EAR. — In 1915 there was a signifi-nt difference in the number of rows of kernels on the ears; this difference mained constant during the succeeding generations. As this character determined by inherent tendencies, and is less susceptible to external environmental influence than the other characters considered, we should pect smaller fluctuations.

TABLE I — *Biometric Values obtained in* 1905.

Types of maize	Mean length of ear; inches	Mean circumference of ear; inches	Mean weight of ear; ounces	Mean numb of rows of kernels
High-protein	7.21 ± 0.04	5.71 ± 0.01	7.53 ± 0.04	13.72 ±
Low-protein	7.80 ± 0.04	6.51 ± 0.02	9.66 ± 0.10	14.71 ±
High-oil	6.87 ± 0.04	6.05 ± 0.01	7.79 ± 0.07	15.65 ±
Low-oil	7.48 ± 0.04	6.65 ± 0.02	9.84 ± 0.05	12.80 ±

CONCLUSIONS. — The selection of chemical characters influences certai anatomical characters and leads to a progressive differentiation in lengt of ear; circumference of ear; mean weight of ear; number of rows kernels per ear.

These two last characters present, in the case of the 4 strains studie values and differences which remain constant even when the climatic a soil conditions vary.

There is an interesting correlation between the dimensions and weigh of the ear on the one hand, and the height of the insertion of the ear the stalk, on the other. There are 2 distinct cases :

1) In plants with 2 ears, the upper ear was, on an average, larger an heavier than the lower one. In 1909 the values given in Table II were found

TABLE II. — *Biometric Values in Plants with* 2 *Ears in* 1909.

	Mean length of ear; inches	Mean circumference of ear; inches	Mean weight of ear; ounces	Number of rows of kern per ear
Upper ear	8.325 ± 0.062	5.976 ± 0.028	7.69 ± 0.12	16.76 ±
Lower ear	6.512 ± 0.097	5.373 ± 0.036	4.51 ± 0.14	16.32 ±

These differences remained constant throughout the whole period observation.

2) In plants with a single ear, low-ear strains and high-ear strains we

TABLE III. — *Biometric Values in Plants with One Row of Ears in* 190

	Mean length of ear; inches	Mean circumference of ear; inches	Mean weight of ear; ounces	Number of rows of ke per ear
High-ear plants	6.380 ± 0.039	6.148 ± 0.018	6.980 ± 0.080	18.09 ±
Low-ear „	6.700 ± 0.035	6.540 ± 0.020	7.705 ± 0.080	18.96 ±

to be distinguished. The ears of the first were, as a rule, longer, thicker and heavier than those of the second, and also bore more rows of kernels. In 1908 the values given in Table III were obtained.

The differences observed in 1908 remained constant for 6 consecutive years.

31 – **"Quality", a New Variety of Sbrawberry.** — ANTHONY, R. D., in the *Journal of Heredity*, Vol. VIII, No. 11, p. 509. Washington, November, 1917.

From the cross of the Johnson Late Strawberry with Sharpless made in 1889-90 by HUNN, about 400 hybrids were obtained. Of these, only one seemed of value and was named after its originator. In 1898, the Hunn variety, pollinated by Atlantic, gave many hybrids, of which only one survived and was called "Quality". In 1907, seedlings of this plant were obtained by self-pollination. Two of these were retained for a study of sex, one of which was perfect (with both stamens and pistils), the other imperfect (with pistils only). The perfect plant was self-pollinated and gave seedlings lacking in vigour, of low yield and with small berries. The imperfect plant, pollinated by the perfect one, gave large, very vigorous and extremely productive plants with fruit above the average in size. By propagating this variety a very valuable commercial type might be obtained.

32 – **Hybridisation Experiments: Between Species of *Dolichos*; Between Species of *Phaseolus*; Between the Genera *Dolichos* and *Phaseolus*.** — See No. 51 of this *Review*.

33 – **The Selection of Cotton for Resistance to Black Scale, in St. Vincent, East Indies.** — See No. 117 of this *Review*.

34 – **Results of the Enquiry of the Office of Agricultural Information of the French Ministry of Agriculture on Manitoba Wheat** (1). — *Feuille d'informations du Ministère de l'Agriculture*, Year 22, No. 15, p. 10. Paris, Novembre 6, 1917.

The Manitoba wheat distributed in the spring of 1917 among the different departments was grown under very varying conditions. The results of the enquiry made by the Office of Agricultural Information lead to the following conclusions:

Soil. — Manitoba wheat does well in all wheat soils, that is to say, medium loams, calcareous loams and rapidly drying silt soils. As a rule it does not do well in calcareous soils or in heavy clay. Nevertheless, in the limestone districts of the Meuse department satisfactory results were obtained. As a general rule, however, healthy soils, sufficiently rich in water at the time of sowing are to be recommended.

Climate. — Manitoba wheat appears to be very resistant to drought; scorching was reported from the Ain department only. It does well in the mountains, at a height of 5 250 feet in the Upper Alps and 2 300 feet in Upper Savoy.

Cultural Methods. – *Preparation of the soil.* — Manitoba wheat requires a very clean tilth in order to give good results. In spite of its rapid

(1) For the experiments on Manitoba wheat see *R.* April, 1917, No. 336 and November, 1917, No. 1011. (*Ed.*).

growth it easily becomes weedy. Information obtained from all over France shows that the yield is satisfactory only if the ground is thoroughly prepared by two autumn ploughings and shallow cultivation in spring, before sowing.

Manuring. — Farmyard manure mixed with superphosphates seems to have given better results than chemical fertilisers alone.

Sowing. — Careful sorting of Manitoba wheat seed appears indispensable : the seed used in 1916 included at least four varieties, two of which were bearded. The small seeds only gave medium results. All directors of agricultural departments recommend close sowing in perfectly healthy and thoroughly drained soil. This condition explains the differences noticed with regard to the dates considered the best for sowing. The departments of Côte-d'Or, Drôme, Gard, Rhone, Manche, Meuse, Morbihan, Vienne and Gironde, advise sowing before the end of March. The February sowing in Upper-Vienne did exceptionally well, but the results obtained with late sowing were very good in the departments of Eure-et-Loire, Orne, Eure, Calvados, Indre, Nièvre, Pas-de-Calais, Sarthe. In the departments of Eure and Orne it was possible to sow as late as May 15th.

Resistance to Rust. — The enquiry showed clearly that Manitoba wheat is very resistant to rust. In the districts in which rust was rife, this wheat was either completely immune or much less attacked than the local varieties.

General Results. — The results were mediocre in Ariège, Aude, Dordogne, Doubs, Finisterre, Meurthe-et-Moselle, Morbihan, Upper Pyrenees, Lower Pyrenees, Seine-et-Oise and Tarn-et-Garonne. In all the other departments the results were good or very good, and the yields better than those of the local spring varieties, though not so high as those of the local autumn varieties.

35 — **Results of the Cultivation of the Carlotta Strampelli Hybrid Wheat in Rice Fields in Italy** (1). — MARCARELLI, B., in *Il Giornale di Risicoltura*, Year 7, No. 17, pp. 213-215. Vercelli, September 15, 1917.

In 1914-1915, and again, in 1915-1916, the Vercelli Rice-growing Station carried out experiments in the cultivation of Carlotta Strampelli wheat. During the second year, the effect of the date of sowing and different quantities of seed were tested. Sowing carried out on October 15th. with 75.83, 89.21 and 98.13 lbs. of seed per acre, gave 24.82, 25.14 and 25.86 cwt. per acre ; that carried out on October 25th. with the same quantity of seed gave 23.54. 24.50 and 24.74 cwt. per acre, and that of November 4th. gave 19.24, 19.16 and 17.82 cwt. per acre. The best harvests, then, were obtained with the earliest and thickest sowing. Cologna Veneta wheat, cultivated under the same conditions, yielded from 18-19 cwts. per acre (*Il Giornale di Risicoltura*, Year 1, No. 19, pp. 291-296, October 15th., 1916).

In view of these good results, the Rice-growing Station provided farmers with a certain quantity of Carlotta Strampelli wheat to be grown ex-

(1) See also *B.* 1915, No. 167 ; *R.*, 1916, No. 1175. (*Ed.*)

perimentally and compared with the varieties usually cultivated by them. Five farmers obtained the following results (very unfavourable year): —

1) Carlotta Strampelli	8.26 cwt. per acre	Gentil rosso / Hybride inversable	7.16 cwt. per acre
2) Carlotta Strampelli	10.24 " "	Cologna Veneta / Rieti	8.66 " "
3) Carlotta Strampelli	15.58 "	Cologna Veneta / Varesotto	12.08 " "
4) Carlotta Strampelli	11.94 "	The other varieties gave a rather lower yield.	
5) Carlotta Strampelli	16.10 "	Cologna Veneta	13.12 cwt. per acre.

In all cases the Carlotta Strampelli variety showed marked resistance to lodging, great vigour and slighter encroachment of weeds.

" With a few exceptions the wheats now grown in the Vercelli district are not well adapted to the conditions of soil and atmospheric moisture, to the fertility of many soils. The greater part were introduced from dry, or only partially irrigated districts, without special attention being paid to the characters of the varieties and their cultural requirements. Many have a limited proportion of culms and leaves, and they ripen too early to profit by the local climatic conditions, without having on that account a greater resistance to lodging and a good production. The varieties which, in rice fields, give a high yield, are those with tall, strong straw, with large leaves, a rapid growth from the beginning, so as to limit as much as possible the development of weeds, a rather late ripening period, and a large number of grains in proportion to the length of the rachis. In these respects Carlotta Strampelli wheat seems preferable to all others ".

36 – **Trials of Different Methods for the Cultivation of Winter Wheat, in the Great Plains Area, U. S. A.** — See No. 11 of this *Review*.

37 – **Rye-Growing in Uncultivated Rice-Fields ; in Italy.** — MARCARELLI, B., in *Il Giornale di Risicoltura*, Year VII, No. 17, pp. 210-213. Vercelli, September 15, 1917.

Rye-growing in rice-fields, without any previous preparation of the soil, can be carried out according to the rules recently suggested by Prof. NOVELLI for sowing wheat on uncultivated rice-land.

For this purpose the land should be wet and light, not too fertile, and not likely to pay for growing wheat. The rye is sown from mid-September to the end of October, before the rice harvest and just before turning the water away from the rice-field, taking care that the soil be quite free from water two days after sowing.

Where water is available, the rye may be sown on the rice stubble, previously inundating the ground, for, to obtain the best results with this method, the rye seeds must be sown on inundated ground, to obtain the greatest adherence of the grains to the muddy ground, followed by prompt germination. In this case, and if calcium cyanamide is available, a first nitrogenous manuring of 0.8 cwt. per acre may be given some days before admitting the water. In any case, from 18 to 23 lbs. more seed per acre than usual have to be sown to assure abundant vegetation and to make up

for the inevitable loss that occurs during germination and the young stages of the plant.

Immediately after the rice harvest, all the irrigating canals must be well looked after, deepening them a few inches and making new ones if there are not sufficient present. The dikes should be destroyed, and if mineral fertilisers are available, 62 to 72 lbs. of sulphate of ammonia and 1.6 to 2.4 cwt. of superphosphate should be give per acre, this is, if calcium cyanamide has not already been applied.

At the end of winter, before the rye has commenced its new growth, a slight harrowing should be given so as to break up and bury the stubble, and provide a good surface tilth. During the later stages of growth, no other attention need be given, save that the drainage ditches should be maintained in good order and a nitrogenous manuring applied if the cereal has suffered from the winter.

After the rye is harvested, the ground can be used for rice by employing transplanting, or, after sowing a cover crop of clover or some other leguminous plant in the beginning of March, a good cut of fodder may be obtained the same year.

The writer considers the advantage of substituting wheat by rye under the present exceptional conditions, when it is necessary to produce the greatest possible quantity of cereals. He further adds :

In many rice-growing districts of Piedmont, 1 acre of ground only produces 15 to 18 bushels of wheat, while it produces 22 to 24 bushels of rye. When there is a shortage of phosphatic manures and labour for cultivating the crop, rye is indicated as it requires less attention and is more hardy, quickly covering the ground and smothering weeds. This latter quality give the result that, when rice follows rye, the former requires less cleaning.

It should be remembered that rye is harvested 20 to 25 days before wheat, that is to say, at the period when the provision of wheat and, in general, cereals used for bread making, is the most required

38 - **Various Fibres Examined at the Imperial Institute, London.** — See No. 5 of this *Review*.

39 - **Flax Cultivation Trials in Egypt.** — See No. 5 of this *Review*.

40 - **Cotton Growing in Australia.** — See No. 5 of this *Review*.

41 - **New Paper-Making Materials Examined at the Imperial Institute, London.** - See No. 5 of this *Review*.

42 - ***Ricinodendron Rautanenii*, An Oil-Yielding Euphorbiaceous Plant of the South-African Veldt.** — See No. 5 of this *Review*.

43 - **New Oil Seeds from American Palms.** — See No. 5 of this *Review*.

44 – **The Indigenous Tan and Dye-Producing Plants of New Zealand.** — ASTON, B. C., in *The Journal of Agriculture*, Vol. XV, No. 2, pp. 55-62; No. 3, pp. 117-128. Wellington, August 20 and September 20, 1917.

The writer reviews the literature of the subject and draws attention to the fact that the ancient Maoris extracted the vegetable dyes, which they used for dyeing their garments, from the following trees and shrubs: —

Pure-black colours were obtained from the hinau small tree (*Elaeocarpus dentatus*) and the pokaka (*E. Hookerianus*), and to a less extent from the towai or beech trees (*Nothofagus fusca* and *N. Menziesii*) the tawhero-tree (*Weinmannia racemosa* and *W. sylvicola*) and hange-hange shrub (*Geniosloma ligustrifolium*).

Blue-black colours were obtained from the tutu or turakihi shrubs (*Coriaria ruscifolia*) and the mako-shrub (*Aristotelia racemosa*).

Red-brown colours were yielded by the toatoa or tanekaha tree (*Phyllocladus trichomanoides*) and makamaka-shrub (*Ackama rosaefolia*).

Yellow, golden or brownish-yellow colours were got from the karamu-shrub (*Coprosoma* sp., probably *C. lucida* or *C. robusta*), raurekau-shrub (*Coprosoma grandifolia*) and puriri-tree (*Vitex littoralis*).

A blue colour was said to have been obtained from the whakou-shrub, or small tree (*Eugenia maire*).

It is significant that, in the majority of cases, the colouring of the fibres was effected by the aid of plants extremely rich in tannin, or closely allied compounds.

The following data are given as regards modern experience and research in New Zealand tannins and dyes: —

PLANTS FURNISHING DYES. — *Aristotelia racemosa* (makomako, or wineberry). The bark supplies a blue-black dye.

Tetragonia trigyna (New Zealand spinach) yields a purple fluid used for ink. The fruit of *Schefflera digitata* and the juice of the root of *Phormium* were also used for this purpose as well as for tanning.

Coprosoma spp. This genus of *Rubiaceae* (which includes 40 species), is restricted in habitat to Australasia, the Pacific Islands, New Guinea and Borneo. Many of its representatives are amongst the commonest and most widely distributed native shrubs. Their bark, and especially the cortex of the root, are of considerable tinctorial power, as in the case of *Coprosoma grandifolia* (orange-yellow); *C. linariifolia* (bright-yellow), *C. lucida; C. rotundifolia; C. rhamnoides; C. foetidissima; C. microcarpa.*

The preliminary tests of the writer have shown that there is reason to believe that closely similar, if not identical, dyes to those of madder (*Rubia tinctoria*) are to be obtained from *Coprosoma* roots, which have the economic merit of being larger than those of the former plant.

Vitex lucens (syn. *V. littoralis*) (puriri), furnishes, with various mordants, different yellow and brown tones. it has been suggested as a source of khaki dye for military material. Some of the lichens used for dyeing purposes in Scotland are also to be found in New Zealand: *Parmelia caperata, P. saxatilis, P. parietina, P. perlata, Lecanora tartarea.*

PLANTS FURNISHING TANNINS. — *Elaeocarpus dentatus*, (Hinau); the bark

contains from 19 to 20 per cent, of tannin; it is also used for dyeing.

Elaeocarpus Hookerianus (pokaka). The bark contains tannin. *Coriaria ruscifolia* (syn. *C. sarmentosa*) contains tannin in all parts of the plant.

Ackama rosaefolia (Makamaka) — *Weinmannia sylvicola* (Tawhero or Towai), *W. racemosa* (Towai or Tawero in the north, Kamaki in the south Island) — *Eugenia maire* (Whakou or Wawhakou or Kiwaka), with 16.7 per cent. of tannin in the bark — *E. Smithii* with 10.7 per cent. — *Fuschia excorticata* with 5.3 per cent — *Metrosideros* spp. (with 15 to 18.35 per cent of tannin in its bark). — *Fagus* spp. (syn. *Nothofagus*) — *Podocarpus spicata* (Matai or Black Pine) — *Dacrydium cupressinum* (red pine or Kimu) — *Phyllocladus trichomanoides* (celery-topped pine = Tanekaha, Toatoa) with 28.66 per cent of tannin in the bark — *Phyllocladus glauca* (Toatoa) and *Ph. Alpinus* (Mountain Toatoa) with tannin in its bark and phyllodia, and perhaps toii (*Cordyline indivisa*), supply a large amount of tannin.

BBER, ND RESIN ANTS. R CROPS

45 – ***Melanorrhœa usitata*, a Plant from Burma and Siam Producing a Black Lacquer.** — See No. 5 of this *Review*.

46 – **Sugar Cane Cultivation and the Manufacture of Sugar in the Republic of Salvador, Central America.** — DOWNIE, HARRY A., in *The Louisiana Planter*, Vol. LVIX No. 18, pp. 283-286. New Orleans, November 3, 1917.

I. — CULTIVATION. — A description is first given of the methods usually adopted in Salvador: the cane is planted between rows of maize, and all work is done by hand. The author then describes the methods he adopted at La Labor de Duran, using machines, with which he obtained better results, both as regards increased yields and reduced labour. The method is as follows:

Preparation of the land, in June, July and August; a MOLINE plough, cutting to a depth of 9 inches was first used, then a MAPES sub-soil plough, also cutting to 9 inches.

Harrowing (about 6), with disc harrow, every 15 days during summer to keep down weeds.

Preparation of furrows for planting (best time September or October), the furrows were made in squares 7 feet apart both ways, so as to plant 900 plants per acre; these furrows were about 15 inches deep and the plough followed by a small two-horse plough, loosening the subsoil to a depth of about 6 inches.

Planting, the cane was planted at the intersecting points of the marking out, from 4 to 6 selected cuttings of 3 eyes each, planted slantwise, with the eyes looking up, and lightly covered.

Harrowing, with a small-toothed harrow 6 days after planting.

During the rest of the rainy season a MOLINE plough cultivator was used every 10 days, going the way of the furrow till this was filled up, and afterwards all possible ways that the planting admitted.

During the dry season a MOLINE cane cultivator was used every 15 days.

The cost of work done by machine is only slightly less than that done by hand, but with machines 2 men per day can care for 6 acres, whereas 48 men are required to do the same work by hand, so that, by using machines, labour may be diverted to other work.

Not only was the crop (25 to 40 tons per acre) larger with machines, but the juice obtained was better, perhaps on account of the wide planting.

The cane was cut by hand, well down, if possible under the ground.

II. — MANUFACTURE OF THE SUGAR. — On small holdings the sugar is obtained by very simple methods. It is consumed in the country and known under the following names, which also indicate the quality and origin: — 1) *panela* or *dulce*, a dark brown product, sometimes rather lighter, containing all the molasses; 2) *pilon*, a white or brown sugar, run into moulds and clarified after boiling; 3) *Mascabado* or *Muscovado*, a light or dark brown sugar made on some holdings. To make this, the mascabado, immediately after boiling, is beaten up to a powder and dried in the sun. This sugar keeps well in the dry season, but goes wet in the rainy season.

It is difficult to estimate the cost of making these sugars, because the work is done by members of the family and friends, who are only paid very little.

Large sugar producers may be divided into two groups — the Trust group and — the outsiders. The trust group has 7 factories with a total production of 150 000 quintals. The outsiders have 9 factories producing 50 000 quintals. The trust group have enough land to raise their annual production to a million quintals, and the other group could do the same. There are also 1 000 000 acres of land suitable to sugar growing, an important factor in the progress of the industry.

Most of the sugar made by the large producers is consumed in the Republic, but a fair amount is exported to San Francisco.

No improved methods of manufacture are used. The smaller plants, where there is only a single crushing, yield about 125 lbs. per ton of cane; in the larger plants the yield is from 140 to 195 lbs. per ton of cane. There are three qualities of sugar: 1) good white sugar; 2) nearly white sugar; 3) light or dark brown sugar. The prices are respectively 12, 11 and 9 *pesos* (1) per 100 lbs. The cane is generally of very good quality, the juice running from 9° Beaume at the beginning of November, and 12 and 13° Beaume in February and March.

7 - **_Capparis albitrunca_, a South African Plant Furnishing a Coffee Substitute.** — See No. 5 of this *Review*.

8 - **Production of Santal Oil in Mysore, British India.** — See No. 5 of this *Review*.

9 - **Tobacco Growing in Ireland (The Experiments in 1916).** — KELLER, G. N., in *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XVII, No. 3, pp. 461-466. Dublin, 1917.

The current scheme of tobacco experiments in Ireland, covering a period of ten years, and financed out of the Development Fund, was inaugurated in 1914.

The number of growers, the total areas cropped in 1916, at the two centres where experiments were conducted, and the quantity of tobacco produced at each centre are as follows:

(1) 1 *peso* = 1s. 9d. at *par*. (Ed.).

Centre	No. of Growers	Acres	Preliminary Packed Wt. lb.
Adare, Co. Limerick; Mullacrew, King's Co.	51	83	(1) 11 500 (estimated)
Randlestown	67	89	58 668

(1) 43 000 lb. dry weight were destroyed by fire on January 1st., 1917.

The varieties grown were: Copper King and Kentucky Black. At Randlestown centre, Rich Wonder and Yellow Mammoth, two varieties closely akin to Copper King and Kentucky Black were also grown on a commercial scale. The following varieties in addition were grown at Randlestown centre for the purpose indicated:

2 acres of Burley } For the production of bright pipe cutters
2 3/8 » Irish Gold }
1 1/4 » » » For the production of a cigarette tobacco of the Virginia type.

At Adare centre three roods of Irish Gold and a half acre of Giourkioi were grown for the production of cigarette tobacco of the Virginia and Turkish types respectively. In addition to the seven varieties which were grown on a commercial scale, tests were conducted on a small scale at one centre with two varieties and three hybrids.

The results of experiments with varieties were as follows:

For Roll and Plug. — No variety tested proved better than Copper King, which had a superior habit of growth.

Bright Pipe Cutters. — Broad Leaf Burley and Irish Gold proved quite suitable for the production of bright pipe cutters, but both varieties were very susceptible to root rot, and also proved much more difficult and expensive to cure than heavy dark tobacco.

Cigarette Tobacco. — A severe attack of root rot seriously interfered with the experiments with the Irish Gold variety for cigarette purposes. At one centre a half acre of Giourkioi, a Turkish variety, was planted very late and gave a very poor return.

The results of the year's work with bright tobaccos, suitable for cigarette and pipe cutters, emphasized the fact that the production of these types of tobacco involves greater difficulty and risk than the production of heavy dark tobacco.

Experience and careful tests have shown that it is very difficult to cope with the root rot disease, caused by the fungus *Thielavia basicola*. Some crops were imperceptibly damaged, others were almost completely destroyed. Tobacco grown on moory land and rich friable loam suffered least.

For the rehandling of the 1915 crop both centres were equipped with the latest pattern of PROCTOR continuous, automatic, redrying and ordering machine.

The experiments indicate that a Proctor machine would be a very effi-

cient and economic instrument in the preparation for market of Irish tobacco if the growing of the crop were on an extensive and permanent basis. The rehandling equipment at each centre represents a capital outlay of, approximately, £ 2000.

Under commercial conditions, such as exist in America, the annual charge for this equipment would be distributed over the produce of 1000 acres or more.

Any tobacco produced in 1915, which was not sold to factories controlled by the experimenters, was disposed of through tobacco brokers and merchants.

In 1915 the preliminary packed weight of the tobacco grown on the total area of $225\frac{1}{8}$ acres was 144 289 lb. Of this quantity a total of 132 689 lb. has been sold at an average price of *7d.* per lb. The cost of growing pipe tobacco in 1915 ranged from *3d.* to 11.8*d.* per lb. and the cost of rehandling at the different centres ranged from 1.6*d.* to 3.3*d.* per lb. These figures are exclusive of any charges in respect of capital or supervision. The packing and bonding of the 1916 crop has not yet been completed. No difficulty is anticipated in selling the crop, the prohibition of the importation of tobacco having strengthened the demand and increased the prices for Irish grown tobacco.

30 – **Tobacco from Northern Nigeria.** — See N. 5 of this *Review*.

31 – **The Leguminosae *Dolichos melanophthalmus* and *D. sesquipedalis* as Vegetables in Italy.** — RAGIONIERI, ATTILIO, in *Bullettino della R. Società Toscana di Orticoltura*, Year XLII, No. 10, pp. 149-151. Florence, October 15, 1917. II

The dolichos cultivated in Tuscany under the names of "fagiolini dall'occhio" or "fagiolini di Sant'Anna", belong to a mixture of numerous forms and varieties of *Dolichos melanophthalmus*. By separating and selecting them it would be easy to obtain improved species.

For over a century the asparagus bean ("fagiolo asparagio" or "dolico gigante" or "fagiolo di Cuba"), considered to be an improved species of *Dolichos sesquipedalis*, has been cultivated in Tuscan gardens. It is a climbing plant which reaches a height of about 10 feet. The green pods, about 18 to 20 inches long (when quite ripe they are about 31 inches long) are eaten. They are grown in soil dug deeply at the beginning of winter and manured with well rotted manure, superphosphate and a little potassic fertiliser. Sowing is carried out in mid-April in trenches from 35 to 39 inches apart, the seeds are placed two or three together at distances of about 10 inches. When the plants are large enough they are hilled up, usually after an application of liquid manure. After this all that remains to be done is to fix the plants on to their supports (cane fences, etc.) and to water them abundantly. The occasional application of liquid manure when watering during the summer improves the yield, which starts towards the middle of July and continues till the first white frosts.

Crossings between the various *Dolichos* are very easy, whereas those between the various *Phascolus* are very difficult. Crossing *Dolichos* and *Phascolus* never succeeded.

52 - **A Simple Method for Forcing Rhubarb in the Open Air.** — DUFOUR AUGUST, in *Bulletin de l'Association des Maraîchers de Genève*, Year XXVI, No. 52, pp. 12, 13 + 1 plate. Geneva, November, 1917.

Among the many methods in use for forcing rhubarb in the open air a very simple one consists in using an old cask, the bottom or end of which has been removed, the other being left.

After having dressed the foot of the rhubarb in November with fresh horse manure, the cask is placed over the roots and surrounded with a sufficient quantity of stable manure and litter to warm the plant and help the leaves to grow. A heat of from 25 to 30° C. is thus obtained. If too great a heat is to be feared air is let in through the bung-hole.

The following English and American varieties are distinguished by their earliness and are well adapted to forcing: — Early Laxton Rhubarb, deep coloured; Hotdays Giant; Hanke's Champagne; Daw's Champion; Johnston St. Martin; Dancer's Early Scarlet; Mitchell's Royal Albert; etc. (1).

53 - **The Work of the Philippine Bureau of Forestry.** — FISCHER, A. F. (Director of Forestry), in *Annual Report of the Director of Forestry of the Philippine Islands for the Fiscal Year Ended December 31, 1916. The Government of the Philippine Islands Department of Agriculture and Natural Resources, Bureau of Forestry*, pp. 83. Manila, 1917.

This Report of the Director of Forestry of the Philippine Islands shows in the first place, that the Bureau has continued the propaganda work carried out to show the people the benefits to be derived from the forest law. The wood expert has also done important work in the study and identification of the trees and their products (2). Considerable surveying and inspection work was also done. Besides the ordinary work of the Administrative Division, mention must be made of the Division of Investigation, whose staff also gives instruction in the Forest School. The chief work carried out by this Division consisted in reconnaissance work, supplying information for the forest maps, dendrology (flora of the forest reserves devoted to experimental work; check list of woody plants of the Philippines; research on rattan [*Calamus Rotang*], rubber and bamboo plants), silviculture (growth studies, silvical notes, reproductive studies, planting, seed collection).

Reforestation is of paramount importance in the Philippines, for over 40 % of the total area is covered with cogon grass (*Imperata exaltata*), which is useless for grazing, is a fire menace, exhausts the soil and is a breeding place for locusts. Its destruction, which is necessary to protect the crops entails great expense. A tree, ipil-ipil (*Leucaena glauca* Benth.), has been found which will kill out cogon grass within two years. Besides this tree hunbang (*Aleurites moluccana* Willd.) and bagilumbang (*Aleurites trisperma* Blco.) were also planted.

The lumber trade improved in 1916. The principal markets for the product are those of Hongkong, China and the United States, besides the

(1) See also *R.* September, 1917, No. 824, p. 1260, under RHUBARB. (*Ed.*) (2) See: SCHNEIDER E. E. (Wood Expert, Bureau of Forestry), Commercial Woods of the Philippines: Their Preparation and Uses, in *Department of the Interior, Bureau of Forestry, Bulletin* No. 5, pp. 274 + 12 figs. 8 plates. Manila, 1916.

cal market. The shortage of coal and its high cost gave, at the end of 916, a great impulse to the production of fire wood, which is also used on ıe railways. In 1916, the production of fire wood reached 292 336 cubic etres (1 cubic metre = 424 board feet).

The Bureau of Forestry of the Philippine Islands administers 16 mil-ın hectares of forests, and includes 201 employees of all grades. In 1916 ıe revenue was distributed as follows :

Appropriations	321 205.20 *pesos* (1)
Revenue	494 447.65
Expenditure	285 708.09
Surplus	208 739.56
Percentage of expenditure to revenue	58 %

The following data on the utilisation of the public and private forests 1916 are of interest.

	Public forests	Private forests
Timber	341 415 cubic metres	2572 cubic metres
Firewood	292 336 »	81 428 »
Charcoal	2 233 »	1 815 »
Dyewood	2 281 466 kg.	—
Tan bark	1 543 686 »	2 237 kg.
Dye bark	93 057 »	8 505 »
Wood oils	63 353 »	—
Gum mastic	1 089 448 »	—
Gum elemi	251 657 »	—
Gutta-percha	19 077 »	—
Split rattan	3 112 126 »	2 187 kg.
Gogo	157 324 »	51 »

The woods most commonly used for timber are those of the Dipterocarpaceae ("lauan", "apitong", "tanguile" or Philippine mahogany, etc.) (2). In 1916 the exports were :

Timber	39 954 cubic metres
Copal	1 143 938 kg
Elemi	104 311 »
Gutta-percha	29 962
Rattan	82 100 *pesos*

LIVE STOCK AND BREEDING.

Studies on Fagopyrismus and Similar Affections in Canada. — BRUCE, E. H., in the *Journal of the American Veterinary Medical Association*, Vol. 411, No. 2, pp. 189-194, Ithaca, N. Y., November, 1917.

Fagopyrismus is an erythema of the unpigmented skin, often accompanied by nervous symptoms and which sometimes ends fatally. Its production requires the following factors: 1) unpigmented skin, 2) in-

(1) *peso* = 2s. 0 1/2 *d.* at par. (2) See *B.* 1915, No. 823 (*Ed.*).

gestion of buckwheat, 3) direct sunshine. Somewhat similar conditio may be produced by *Medicago, Trifolium Hypericum* and *Polygonum*. T writer had occasion to study an outbreak of fagopyrismus in Yorkshi sows and young pigs belonging to the University of British Columbia, whi had been running on a pasture with buckwheat in flower for only 24 hou in August 1917.

Symptoms of the disease. In mild cases, there is erythema and sligh inflammatory swelling accompanied by intolerable itching, the region the head and ears being the most commonly affected. In the sever cases, there may be some disturbance of breathing, digestive trouble, a symptoms of brain affection. Death may result in 12 hours. In mo cases, recovery takes place in a few days.

Treatment. Affected animals should be moved at once into the shad In severe cases, treatment should be given to reduce inflammation.

In May 1916 a herd of Holstein heifers, belonging to the Agassiz (C nada) Experimental Farm, which had been running in woody pasture wh there were large numbers of different species of *Polygonum* were found be suffering from the symptoms of fagopyrismus. The parts directly expos to the sun's rays were affected, the dermatitis being confined to the wh parts of the skin. This fact induced the writer to study the disease.

On July 18th, 3 white pigs were placed in the shade and fed until t 28th. as follows: — one served as a control and was fed on mixed grass a shorts, the 2nd. on shorts and red clover (*T. pratense*); the 3rd received shor and *Polygonum Persicaria*. From July 28 to August 4, the pigs were plac in pens so situated that they could not get out of the sun. The next da the ears of all the pigs were reddened, those of the 2nd. and 3rd. pigs b slightly the worst.

In a 2nd, experiment, made with the same animals, one was fed for days on a diet of *Polygonum Hydropiper* without any results being obtain A yearling Holstein bull, with a great deal of unpigmented skin, was ke from August 10 to 28 in a pen in the open and fed exclusively on *Polygo ceae*: *Polygonum Persicaria, P. Hydropiper, P. aviculare, P. acre, P. hydro peroides*. No ill effects, however, ensued.

In conclusion, there experiments do not confirm the opinion advanc by different writers (PAMMEL, LONG, MÜLLER, FRIEDBERGER, FRÖHNER, etc. that other species of *Polygonum* are toxic, as well as *P. fagopyrum*.

55 - **Eradicating Tall Larkspur on Cattle Ranges in the U. S. National Forests** (1). - ALDOUS, A. E., in *United States Department of Agriculture, Farmer's Bulletin*, No. pp. 23, 8 figs., 1 tables. Washington, August, 1917.

Poisoning by tall larkspur (*Delphinium exaltatum*) causes heavy lo of cattle each year in the National Forests of the United States. Duri the last 3 years, 5 500 head of cattle, estimated at $ 300 000, were lost a nually through poisonous plants; about 90 % of this loss is attributab to tall larkspur. The bulletin describes the efforts made to eliminate t

(1) See *R.* January, 1917, No. 54. (*Ed.*)

is caused by this plant. Experiments made in 1913 and 1914 in the for- :s show that grubbing out the plants is the most effective method. The ırk of eradication was continued in 1915 on about 14 000 acres of cattle ıge in the National Forest.

The work is done by grubbing out the greater part of the root system, cluding the main and lateral roots. The depth depends on the size of e roots ; for medium sized roots (about 2 feet) the depth should be 8 in- es, for shorter roots, 6 inches suffice. Very large bunches often have large, allow lateral roots, which should be removed to at least 4 inches from ıere they leave the main root, for a little more than 6 % of the larkspur rvive the first eradication and grow again from the roots which have en insufficiently removed. Eradication should be carried out during o consecutive years.

The work is best carried out early in the season, as soon as the plants ve grown sufficiently to be easily recognised. The plants may be left read out in the sun for a week, after which they are so dry that the cattle ll not eat them. This method is preferable to that of piling the plants d burning them, and also requires less labour.

The tool used is determined by the nature of the ground, a pick mat- ck, or hoe with the spur cut off and the blade drawn out to about 9 inches, ay be used.

The cost of the first eradication varies from $ 3.65 to $ 10.10 per acre cording to the number of plants, nature of the soil, and whether the range free from rocks, willows and brush. The cost of the second eradication es not exceed $ 1 per acre.

Grazing by sheep, which are not susceptible to the poisoning, has only imited success which depends chiefly on the choice of the most favourable riod, the spring.

Fencing off the infested land by drift fences is more costly than grubb- g and should only be adopted if horses or sheep are available to graze e areas from which the cattle are excluded.

– The Properties of the Serum of Animals Hyperimmunised against Glanders, and the Choice of Animals for the Preparation of Such Serum Rich in Suitable Antibodies. — BERTETTI, E. and FINZI, G., in *Atti della Reale Accademia dei Lincei, Rendiconti, Classe di scienze fisiche, matematiche e naturali*, Series 5, Vol. XXV, Part 5, pp. 131-135. Rome, September, 1917.

The writers have attempted to prepare anti-glanders sera rich in anti- dies by using the following animals : the *ass*, which is very susceptible to nders, and when infected naturally or experimentally, usually suffers m the acute form of the disease ; the *mule*, in which the disease is usually y acute (though acute cases are fairly common in that animal and chro- cases are not rare) ; the *horse*, in which the disease is usually chronic ; *ox*, which is naturally quite immune.

The experiments were as follows :

Immunity obtained by using bacilli killed by chemical means. — On Au- st 30, 1916, a horse received an intravenous injection of a 7- to 8-day. l-culture on agar of glanders bacilli killed with a solution of bichloride

of mercury. The following injections were made in increasing doses; a the 12th. injection 5 agar cultures were inoculated. The first injection were given close together ; afterwards they were given every 5 days up t the end of January, 1917, when they were given every 12 or 13 days.

Immunity obtained by using bacilli killed by heat. — On August 2 1916, a horse, mule and an ass were treated like the horse mentioned above with the difference that the bacilli were killed by heat.

Immunity obtained by means of bacilli killed by heat and by a malleinic toxin. — Two horses and an ass were treated with bacilli killed by heat and by malleinic toxin obtained by a special process.

Immunity conferred on cattle by means of bacilli killed by heat and virulent bacilli. — Two oxen were immunised subcutaneously ; the first received injections of very virulent bacilli grown on agar ; the second received cultures from the same stock, but killed by heat (1 to 6 abundant cultures in Petri dishes). The injections were made regularly every 5 days for about 8 months. The oxen supported the immunising treatment very well.

RESULTS. — In August 1917, the subjects under treatment yielded serum having the following specific qualities : very energetic *precipitating* power ; *agglutinising* power very manifest, even at considerable dilutions *e. g.*, of 1 : 10 000 to 1 : 20 000 (the heat test showed the specific nature of the agglutinins of these sera, in showing that they were such as would confer immunity) ; this serum has abundance of a specific *sensitizing* agent easily recognisable either in presence of *Bacillus mallei*, or in presence of different bacillary extracts.

The animals under treatment did not all yield a serum of equal activity Those inoculated with broth or agar cultures of *Bacillus mallei* and with mallein gave quite inactive serum.

If the *precipitating*, *agglutinising*, and *sensitizing* powers of the various sera obtained are classed by means of numbers from one to ten, the following scale is obtained : serum from oxen, 10 ; serum from horses, 8 ; serum from mules, 4 ; serum from asses, 1 to 2. The power of fixing alexins, precipitating malleinic poisons and agglutinising the various races of *B. mallei* is perfectly proportional for all the sera.

CONCLUSIONS. — 1) It is possible to obtain from the different animals (ox, horse, mule, ass) anti-glanders sera with strong precipitating power in regard to various malleins and cultures of the bacillus obtained by filtration, of high agglutinising power and containing specific sensitizing agents, easily recognisable in presence of the causal organism or its various extracts.

2) The existence of a more or less great individual disposition to glanders has an inversely proportional effect in the production of anti-glanders antibodies. In fact, these antibodies, which show the work performed by the organism in order to acquire immunity, are more abundant in ox-serum and diminish progressively through the horse, mule and ass.

3) According to the writers, the fact the oxen are immune to the disease should not be considered as being related to the lack of affinity

etween *B. mallei* and the cellular units of the organism, as these latter are rtainly and actively affected by *B. mallei*.

4) It is inadvisable to treat the animals with agar or broth cultures the glanders virus together with mallein, with the intention of producng a *complete* serum, for the soluble products of *B. mallei* contained in spension in the broth cultures, or the crude mallein injected, possibly eing modified only slowly, finally neutralise *in vivo* the antibodies produced y the bodies of the organisms, or else the haptophoric (1) group of the precipitin former absorbs and fixes the precipitin.

5) The precipitins contained in the anti-glanders sera prepared by the riters are thermolabile: temperatures between 55 and 60° C destroy the nctional, precipitogenous, and active group of the precipitins, which are anged into precipitoids.

The work was carried out in the "Glanders Research Laboratory" f the 3rd. Italian Army. The writers place their anti-glanders sera at ie disposal of other workers.

37 - **Endoglobular Parasites Causing Diseases of Animals in Russian Turkestan.** — YAKIMOFF, W. L. and collaborators, in the *Bulletin de la Société de Pathologie exotique* Vol. X, No. 4, pp. 302-311. Paris, April 11, 1917.

The authors have observed the following haematozoan diseases of nimals in Russian Turkestan: —

A PIROPLASMOSES. — 1) Bovine piroplasmosis, due to *Piroplasma igeminum*, easily cura[illegible] by injections of trypanoblue.

2) Equine piroplasmosis, caused by *P. caballi*; treatment with trypanoblue has given good results.

(1) According to EHRLICH'S side-chain theory (1885), the cell is composed of a central molecular complex upon the preservation of which the existence and energy of the whole cell pend. Branching off from this central element are atomic groups, the so-called "*side-chains*" "*cell-receptors*". These receptors are differently composed and each possesses its own specific affinity for food molecules brought to the cell by the circulation. These receptors bind turn the food molecules to the cell itself, and as these are taken up and utilised in the cell etabolism, so are also toxins which may be brought to the cellular elements by the body aids. Thus there are *nutro-receptors*, which take up nourishment, and *chemo-receptors*, which ttract chemical bodies. The combination of nutro-receptor with the food molecule is temorary; but with the chemo-receptors, if the toxin be not immediately destroyed, the cell sacfices the receptor to which the toxin is attached. The cell then increases the number of reptors, which may be produced in such number as to be liberated from the cell, and if toxin olecules be present a union takes place between the two. The injection of an immune serum , therefore, equivalent to injecting material containing side-chains.

Ehrlich divides the side-chains, according to their structure into 3 groups: 1) receptors ntaining a single combining or *haptophoric* group, which enables them to unite with a corresonding group of their respective antigens, such as *antitoxins*, *anticomplements*, *antiferments*, tc.; 2) receptors possessing the same qualities as the first, but having an additional group, he *ergophoric* group, and by means of these the antigen is further acted upon; to this group elong *agglutinins* and *precipitins*; 3) *amboceptors*, so called on account of their possessing two ombining groups; the first belong to the *haptophoric* group, uniting the antigen to the cell, nd the second to the *complementophilic* group, which combines the complement of the serum. H. E. WALLIS HOARE, *Veterinary Therapeutics*, 3rd edition, pp. 545-547. London, 1916. (*Ed.*)

3) Sheep piroplasmosis, in which the *Piroplasma* is pearshaped.

4) Goat piroplasmosis.

5) Wolf piroplasmosis, which seems to be very common, $^2/_3$ or $^3/_4$ of the animals examined at the abattoirs of Taschkente and Boukhara being attacked, the majority only slightly; the parasites seem to resemble *Theileria*; in one case a parasite was found which was morphologically similar to *P. canis*, though it had not been found in dogs (the authors have examined practically only town dogs).

B. THEILEROSES. — 1) Bovine theilerosis occurs in two forms: acute and chronic; the first form appears to last several days, then becoming chronic. The disease is probably caused by *Theileria mutans* or some related organism.

2) Sheep theilerosis, caused by *Th. ovis*.

3) Camel theilerosis, for which the authors have founded the species *Th. camelensis*.

4) Fox theilerosis.

C. NUTTALLIOSES. — 1) Horse nuttalliosis, caused by *Nuttallia equi*.

2) Ass nuttalliosis.

D. ANAPLASMOSES. — 1) Bovine anaplasmosis, due to *Anaplasma marginale*; described as marginal points, nearly always associated with theilerosis.

2) Horse anaplasmosis.

3) Dog anaplasmosis.

58 - **Notes in Regard to Bots, *Gastrophilus* spp.** — HALL, MAURICE C, in the *Journal of the American Veterinary Association*, Vol. LII, No. 2, pp. 177-184. Ithaca, N. Y., November, 1917.

The experiments described were carried out at the Research Laboratory of Messrs. PARKE, DAVIS and Co., Detroit, Michigan. In order to make sure that the parasites had been expelled the treatment was, in some cases, followed by a post-mortem examination. Carbon bisulphide (recommended by PERRONCITO and BOSSO in 1894, and by many later authors) is very efficacious against bots, expelling all the larvae. The U. S. Department of Agriculture recommends 4 doses from 10 to 12 mg. each, administered at intervals of 1 hour. The author, in his experiments, gave a dose (in capsule) of 12 mg. followed by a second dose in 1 ½ hours, and, 1 ½ hours later, 800 mg. of linseed oil; a few days later 3 doses of 12 mg. each were given at intervals of 1 hour.

Chloroform and oil of chenopodium are of no value against bots.

G. intestinalis (*G. equis*) may cause myiasis in dogs to which are fed well developed larvae from the stomach of the horse. *G. nasalis* and *G. hemorrhoidalis* only adapt themselves to the dog to a limited extent.

59 - **Observations on a Contagious Camel Disease Called "Jhooling" in British India.** — CROSS, H. E., in *Agricultural Research Institute Pusa, Bulletin* No. 72, 7 pp. + 1 fig. Calcutta, 1917.

"Jhoolak" or "Jhooling" is a contagious disease of camels manifesting itself in the formation of local tumours, hot and painful, of a fibrous character, and terminating in suppuration and raw patches. The disease is widely

istributed throughout the Punjab. It usually occurs in cold weather, ut is met with occasionally in hot weather. The causal organism has not et been isolated, though it is probably a fungus. Horses, buffaloes and a;tle kept in contact with camels suffering from Jhooling do not contract 'e disease, nor can it be produced in them by inoculation of emulsion of he lesion, nor by rubbing portions of the lesion on their skin, whether the kin be scarified or not. On the other hand, healthy camels kept in contact ith camels suffering from Jhooling contract the disease rapidly.

As a preventive measure, the writer advises the isolation of infected nimals. The best treatment, and one which gives very satisfactory results ; the following: — A strong red iodide of mercury blister should be applied, nd after 3 days washed off with soap and water. The diseased areas should hen be excised and finely powdered permanganate of potash applied. Three ressing at intervals of 4 days are usually sufficient.

o - **The Mortality of Rabbits in Wet Years in Consequence of Coccidiosis.** — RAILLIET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 31, pp. 979-986. Paris, November 7, 1917.

On account of the importance of rabbit breeding on account of the war, nd in consequence of the high mortality of this animal in wet years, the riter shows that the chief cause of the mortality is *coccidiosis*, which oc- urs in two chief forms: *hepatic* and *intestinal*; both of which may be *acute* r *chronic*.

The symptoms and course of the disease are described (being practi- ally identical in both forms); the life-cycle of the parasite is then described. he parasite only produces sporozoites (the agents of infection) when the nvironment is damp, which explains why coccidiosis is prevalent in wet ears.

The preventive measures for controlling the disease are described: olating or destroying diseased or suspected animals; burning or deeply urying the corpses or viscera; disinfecting the litter with water contain- ng 40 grms. of sulphuric acid per litre or sprinkling it with quicklime; isinfecting the cages by washing them in boiling water; not crowding the abbits together; early separation of young from adult animals; placing he hutches in healthy, well ventilated and dry places; giving dry or cooked ood in preference to green stuff, particularly when earthy and wet; putt- ng the food in trellised mangers, placed at a certain height; providing lean, fresh water in drinking troughs that are easy to clean.

As regards treatment, the writer states that he knows no sure one. ome veterinarians prescribe atoxyl and sodium emetic (sodium tartrate nd antimonyl) but its use is not safe. A less dangerous remedy is advised y English and American writers; such is a solution of iron sulphate or a olution of *cutch* (extract of *Acacia catechu*) both given at the rate of about 0 centigrammes per litre of drinking water. An Italian veterinarian, ANLORENZO, has recently announced the complete cure of intestinal occidiosis of the bull by means of thymol given up to the dose of 15 gm. er day; doses of 25 to 50 centigrammes might be tried with the rabbit.

61 – **Intestinal Parasites of Poultry, Their Prevention and Treatment.** — WICKWARE, A. B., in *Dominion of Canada, Department of Agriculture, Health of Animals Branch, Bulletin*, No. 25, pp. 13 + 3 plates. Ottawa, 1917.

This bulletin was writen for poultry breeders as it was found that, of all the diseases of poultry, those caused by intestinal parasites cause the greatest loss. The annual money losses from preventable causes is at least 10 % of the yearly production of the poultry industry, *i. e.*, about 5 million dollars.

After a short description of the Cestodes, Nematodes and Trematodes found in poultry and the symptoms of infection, the author summarises the various treatments tested by him which may be recommended. One or two teaspoonfulls of turpentine per fowl seems the most efficacious cure and is one which is easily applied. In order to avoid the irritation caused by the turpentine when given through the mouth it is preferable to use a piece of rubber tubing about ¼ inch in diameter. After the tubing has been oiled it is passed gently into the mouth and gradually worked down the gullet into the crop. The turpentine may be passed through the tube by means of a small medicine dropper.

62 – **Feeding Studies: The Causes of the Dietary Insufficiency of Certain Rations.** — See No. 2 of this *Review*.

63 – **On the Impossibility of Watering the Milk by giving Large Quantities of Water to the Cow.** — PORCHER, CH., in *Annales des Falsifications et des Fraudes*, Year 10, Nos. 105-106, pp. 301-320. Paris, July-August, 1917.

On account of the large number of experts and chemists who still believe in "polylactie" or "mouillage au ventre", and the danger of such a belief from the point of view of the repression of fraud, the author (Professor at the Veterinary School of Lyons) shows how incorrect that idea is according to which, the ingestion of large quantities of water by a lactating female is followed by a veritable watering of the milk.

He recalls the physiology of lactation, insisting on the fact that milk is secreted, not excreted. The researches, experiments and conclusions of MALPEAUX, MALLÈVRE, REGNARD, etc., are quoted.

The note concludes that "polylactie" (watering the milk through the cow) does not exist, and that it is nonsense, both physiologically and experimentally, that could not be used as the basis for any reasonable judicial decision.

64 - **Methods for Approximating the Relative Toxicity of Cottonseed Products** (1). — CARRUTH, FRANK E., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 87-90. Baltimore, Md., October, 1917.

The work described was carried out at the North Carolina Agricultural Experiment Station, West Raleigh.

In collaboration with Mr. WITHERS, the author undertook investigations into the cause of cottonseed meal poisoning. These investigations which have not yet been published, showed that, as a rule, the relati

(1) See also *R.* August, 1917, No. 741. (*Ed.*)

toxicity of cottonseed meals varies with the extent to which the raw cottonseed kernels are cooked in the oil mill.

The raw kernels are highly toxic to animals since they contain about 0.6 % gossypol, a highly poisonous phenolic plant pigment. On cooking with moist heat, as in the hot pressing processes, preparatory to expressing the oil, the glands containing gossypol are disintegrated, and the gossypol spreads over the surface of the seed tissue and apparently undergoes a change which appears to be a partial oxidation. This change takes place very rapidly, for some meals which have been cooked for 20 to 30 minutes only are not markedly toxic for rats. The cooking process change the ether-soluble and oil-soluble gossypol to a substance which, *in the meal*, is no longer soluble in either ether or oil, possibly because it is in some way chemically combined with some constituent of the meal (protein). Its presence in large amounts in ether-extracted cottonseed meal may be proved by treating the meal with hot alcoholic potash. The supernatant liquid contains the substance which, like gossypol, soon oxidises, producing a beautiful blue colour. The author calls this substance, which is much less toxic than gossypol, " D " gossypol.

Cold pressed meal is not more toxic than hot pressed meal ; this is due to the fact that, in cold pressed meal, about $^3/_4$ ths. of the total gossypol of the seed passes into the oil. Thus, whereas hot pressing greatly reduces the toxicity of the cotton seed by producing a chemical change, cold pressing reduces it by passing the gossypol into the oil.

If the gossypol is present in the meal it may be extracted by ether or detected by the following microscopic method.

1) *Sulphuric Acid test for unchanged gossypol.* — A little of the meal is sprinkled on a glass slide and treated with a drop of concentrated sulphuric acid. The result is observed through the low power of the microscope. If numerous red areas appear where the acid touches the more or less broken up " glands ", toxic unchanged gossypol is present. Thoroughly cooked meals and cottonseed flour show very few and very small red areas.

2) *Quantitative determination of the gossypol present in cottonseed meal using aniline as a precipitant.* — This method is based on the fact that the unchanged gossypol present in the meal is easily extracted by ether, together with the oil. Gossypol forms a very slightly soluble compound with aniline, which separates from the oily extract and may be filtered out and weighed.

65 - **Food Value of the Waste Leaves of Different Varieties of Cabbage ; Investigations in Holland.** — DE VRIES, J. J. OTT., in *Nederlandsch Landbouw-Weekblad*, Year 26, No. 45, Supplement p. 1. Schiedam, November 10, 1917.

In 1912 the cauliflowers grown in Holland covered an area of 6 000 acres, red cabbage 4774 acres, and white cabbage and common cabbage 4885 acres. Estimating the quantity of waste leaves per acre at 5 ½ tons for cauliflower and from 8 to 8 ½ tons for white and other hearted cabbage, about 120 000 tons of such leaves are produced annually in Holland.

In order to estimate the food value of this waste, analyses were made at

the Hoorn Agricultural Experiment Station. The results obtained ar given in Table I.

TABLE I. — *Composition of waste stems and leaves of different varieties of cabbage.*

	Cauli-flower stems	Leaves of cauliflower		Leaves of red cabbage			Leaves of white cabbag	
		I	II	I	II	III	I	II
Dry matter	16.6 %	11.2 %	—	12.0 %	12.1 %	9.9 %	11.0 %	10.8 %
Composition of dry matter:								
Ash	9.0	24.8	24.3	23.2	18.4	10.5	25.2	22.1
Ash insoluble in water	—	14.8	17.1	15.4	12.6	4.5	17.6	13.7
Fibre	55.0	11.0	16.9	14.7	14.1	15.2	12.6	12.9
Fat	0.8	5.1	3.5	4.8	5.4	3.4	4.2	4.2
N-free extract	24.9	33.4	33.5	41.2	43.0	14.8	42.7	2.9
Crude protein	10.3	25.7	21.8	16.1	19.1	26.1	15.3	17.9
Pure protein	9.3	17.1	18.2	11.4	13.9	15.8	10.4	12.8
Digestible protein	4.5	14.1	13.4	9.3	11.7	14.3	8.4	10.4

These analyses show that: —

1) The food value of waste cauliflower leaves may be compared to that of brewers' grains.

2) Waste leaves of red cabbage have a food value double that of clover hay.

3) Waste leaves of white cabbage have a food value double that of good meadow hay.

Analyses of the different cabbage wastes for their fertilising value gave the results shown in Table II.

TABLE II. — *Percentage of fertilising elements (compared with the dry matter) in the waste leaves of various cabbages.*

	Cauliflower leaves	Red cabbage leaves	White cabbage leaves
	%	%	%
Nitrogen	3.6	2.8	2.0
Phosporic acid	0.54	0.58	0.67
Potassium	1.5	2.0	1.6
Lime	8.2	7.8	8.6

According to calculations based on present day values, the value of such leaves as a food exceeds their value as a fertiliser.

Feeding experiments carried out with this waste on two cows at the Hoorn Experiment Station, show that leaves of cauliflower and white cabbage produce hardly any disagreeable smell or taste in the milk; red-cabbage leaves seem to have a greater influence in this respect, but it is probable

that the milk takes the characteristic taste and smell of the cabbage as a result of being left too long in the byre where the cabbage waste is kept.

The taste and smell of the cabbage may also be passed to the milk from the hands of a milker who has touched the leaves.

Cabbage leaves seem to have no bad influence on the fat content of the milk. During the experiments the cows out at pasture ate an average of from 66 to 88 lbs. of cabbage leaves daily. No bad effect was noticed on the cream. Further experiments will be made at the Hoorn Station to determine the food value of these leaves when kept in silos.

66 – **Acorns and Beechnuts as Food for Cattle** (1). — *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 41, pp. 10-11. Paris, October 30, 1917.

I. *Acorns.* — The latest work on the composition of acorns has shown them to be poor in albumin, yet very nutritious on account of their high content in nitrogen free extract (starch and sugars). They are poor in lime, phosphoric acid and ash. They are characterised by tannic acid, and a bitter element, *quercite* or acorn sugar, substances capable of causing gastric trouble, particularly constipation, if fed to animals in excessive quantities. These injurious effects are increased if the acorns are badly kept or mouldy.

Acorns are not complete foods, and pigs fed on them alone without any other protein food, suffer from cachexia of the bones, many of which fracture, and they lose in weight; their intestines turn greyish.

As a supplement to other rations acorns produce no harmful effects, and are to be recommended. Pigs fed in the sties must not be given too large a quantity of acorns, especially at the beginning of the fattening period. The ration should be completed by green fodder, rich in nitrogen and water. The acorns should be crushed and mixed with other very laxative foods such as tuber or root plants, beet slices and fairly concentrated foods, such as bran. Cooking the acorns or meal made from them may diminish their astringency.

Quantity of acorns which may be eaten by animals accustomed to them in their daily rations.

Horses	9.9 lbs. of fresh acorns	6.16 lbs. of dried acorns.
Dairy cows	9.9 »	6.16 »
Beef or draught oxen	13.2 »	8.14 »
Pigs	3.3 »	2.2 »
Sheep and goats	1.65 »	1.1 »

If only a limited quantity of acorns is available, it is best to keep them for the pigs because, so long as the precautions given above are observed, they have no bad influence on the meat, except on the fat.

It is advisable to use dried acorns without the cups, which are richest in injurious elements.

II. *Beechnuts.* — They have a fairly high food content and are very digestible. As the seed contains a poison, *fagine*, it must only be included

(1) On the use of acorns in distilling, see No. 94 of this *Review*. (*Ed.*)

in the ration of animals to a limited extent. On the other hand, horses may eat 6 ½ lbs. of them a day without any ill effects. Beechnuts, like acorns should be given to pigs by preference. Although they have not the energy value of acorns, beechnuts are a food for cattle which should not be ignored

67 – **The Pulpy Mesocarp of the Fruit of *Ricinodendron Rautanenii* as a Cattle Food.** — See No. 5 of this *Review*.

68 – **The Value of Cider Apples, Perry Pears, and their Respective Pomace as Food for Farm Stock.** — I. BARKER, B. T. P. and GIMINGHAM, C. T., The Use of Pressed Apple Pomace, in *The Journal of the Board of Agriculture*, Vol. XXII, No. 9, pp. 851-858. London, December, 1915. — II. BARKER, B. T., and WALE, B. N., The Value of Cider Apples and Pomace as Food for Farm Stock. *Ibid.*, Vol. XXIV, No. 5, pp. 530-539. August, 1917.

I. — The writers apply the term pomace to the pulp of apples and pears in the condition in which it comes from the press after the juice has been extracted.

The total acreage in Great Britain under cider and perry fruit trees is approximately 100 000 acres; this corresponds to a total annual yield of 27 500 000 gal. or 183 333 to 220 000 tons of fruit, or 55 000-60 000 tons of pressed pomace. The total crop of cider fruit is probably not less than 200 000-250 000 tons, representing a yield of 60 000-75 000 tons of pomace.

Table I gives the results of the analyses of cider pomace carried out by the writers at the Agricultural and Horticultural Research Station of the University of Bristol. For comparison, the composition of wet brewers' grains and of mangolds are also given. Speaking generally, apple pomace is of a distinctly higher feeding value than mangolds, but it falls below wet brewers' grains as regards the amount of protein, though it is richer in carbohydrates.

TABLE I. – *Percentage Composition of Pomace.*

	Mixed apples 1913	Mixed apples 1915	"Jelly" apple 1915	Pounsford apple 1915	Cap of Liberty apple 1915	Pear 1915	Wet Brewers' grains	Mangolds (Medium)
Water	74.10	76.05	68.39	75.39	75.37	65.52	76.2	88.8
Ether extract	1.24	1.12	1.43	1.22	(1.20)	1.30	1.7	0.1
Protein	1.82	1.53	1.93	1.54	1.33	1.50	5.1	1.2
Crude fibre	5.14	4.42	6.52	5.75	4.30	7.86	5.1	0.9
Ash	1.11	0.71	0.65	0.56	0.76	0.92	1.2	1.1
Carbohydrates	16.69	16.17	21.98	15.54	17.04	22.90	10.6	8.7

WARCOLLIER, in his book "Pomologie et Ciderie", quoting from WOLFFS' tables, gives for apple pomace a content of digestible nutrients of about: 1 per cent. of protein; 1.2 per cent. fat; 12.5 per cent. carbohydrates; nutritive ratio about 1:16.

In cider-producing countries, pomace is fed to stock when it is fresh;

if not given in large quantities (which would be injurious, especially in the case of dairy cows), no bad results are to be apprehended. Pomace, however, undergoes a rapid acid fermentation in addition to putrefaction. The best method of preserving it is by making it into silage. The silo may be improvised by using tubs or vats, or it may be specially constructed out of masonry, or dug out in the earth, the bottom and sides being covered with layers of straw. In some of the larger cider factories, pomace-drying plants have recently been installed. The product is sold to feeding-stuff manufacturers, and employed in making compound cakes or poultry foods. When for any reason, apple pomace cannot be used for food, it may be turned into a very good manure. Ordinary samples contain from 0.2-0.6 per cent. of potash; 0.4-0.7 per cent. of phosphoric acid; 1.6 to 1.7 per cent. of nitrogen, so that pomace is richer in manurial constituents than farmyard manure, but to neutralise its acidity, it should be mixed with bone or mineral phosphates.

Pomace can also be employed for making "small" cider, or low-grade cider, as well as for vinegar production or for cider and perry brandy.

II. — Description of experiments made in 1916, with pigs at the Seale-Hayne college, Newton Abbot, in conjunction with the Agricultural and Horticultural Research Station at Long Ashton, in order to determine the effect of substituting apples, or pomace, for a portion of a daily ration consisting of : sharps, maize meal, and fish meal. The quantity of apples given was gradually increased to from $\frac{1}{3}$ to $\frac{1}{2}$ and the pomace till it constituted from $\frac{1}{10}$ to $\frac{1}{3}$ of the total weight of the ration.

The percentage composition of the apples and pomace is given in Table II.

TABLE II. — *Percentage composition of Apples and Pomace.*

	Apples		Pomace	
	Sample 1	Sample 2	Sample 1	Sample 2
Water	83.8	83.0	67.20	71.75
Protein	0.7	0.5	1.90	1.70
Fat	0.4	0.3	1.47	1.05
Crude fibre	1.2	2.0	13.70	12.22
Carbohydrates	13.3	13.2	15.17	11.78
Ash	0.6	0.4	0.56	1.50

The experiment was divided into 2 periods: 1) from 5th. October to 15th. December during which both apples and pomace were used; 2) from 16th. December to 15th. January, during which only pomace was used. The results obtained at the end of each period are given in Tables III and IV. Each group contained 5 animals.

These Tables show that: 1) for fattening pigs of 55 to 60 lbs. per head, neither cider apples nor pomace give as satisfactory results as maize meal

and fish meal; 2) both apples and apple pomace possess a distinct feeding value for older, and store, pigs.

TABLE III. — *Experimental Results for Period I.*

Lots	Live weight at start	Live weight at end of Period I	Gain in live weight in 72 days.	Calculated carcass weight	Food consumed					Total meals	Total meal consumed per lb. live-weight
					Apples	Pomace	Sharps	Maize meal	Fish meal		
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	214	514	300	304.59	1 142	—	517	390	91	1 028	—
2	213	527	314	375.06	570	—	669	390	91	1 150	3.66
3	211	555	344	398.32	—	—	771	390	91	1 252	3.64
4	212	514	302	372.34	73	251	652	390	91	1 133	3.75
5	213	520	307	376.08	35	355	614	390	91	1 095	—

TABLE IV. — *Experimental Results of Period II.*

Lots	Live weight at start	Live weight at end of Period II	Gain in live weight in 30½ days.	Actual Carcass weight	Food consumed			
					Apples	Pomace	Sharps	Maize meal
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
2	527	671	144	491	91	220	425	302
3	555	713	158	526	—	—	515	302
4	514	673	159	501	—	151	454	302

69 - **Inheritance of Coat Colour in Swine: Experiments in the United States.** - SEVERSON, B., O., in *The Journal of Heredity*, Vol. VIII, No. 8., pp. 379-381, 1 f. Washington, August, 1917.

The Mendelian principles of unit characters, dominance, and segregation appear to manifest themselves in the colour characters of pigs. SMITH (Colour Inheritance in Swine, in the *American Breeder's Magazine*, Vol. IV, p. 113) has shown that in the case of a Yorkshire crossed with a Berkshire, or with a Poland China: 1) white was dominant as regards black in the F_1 generation; 2) in the F_2, the colours showed a general tendency to the separate manifestation of the original parental colours, in the ratio of 3 dominants: 1 recessive; 3) in almost every case, the black recessive of the F_2 was accompanied by much more white than was present in the black parents. This suggests the idea that several chromosome factors rather than a single one, are required for each colour. A. I. SIMPSON and J. P. SIMPSON (Analytical Hybridization, *Proceedings of the American Breeders' Association*, Vol. VII, p. 266), in a study on the crossing of different breeds of swine, state that: "The exact application of Mendels' law to all hybrid pigs in those cases where the original animals had been proved to be pure-bred and homozygous, and the resemblance between the pre fertilisation chromosome reduction processs in animals and sexual plants

ds us to conclude that all pure-bred swine fully obey Mendel's law, d that, if in crossing, a marked deviation occurs, this is positive proof contamination in the case of one, or both, subjects".

In the experiments carried out at the Pennsylvania State College the iter observed the following facts: In the spring of 1915 were born a lit- of young pigs, the offspring of a Berkshire sow, Dora XVIII of Penn. ite 199 330 and a Duroc Jersey boar, Fancy King 58 875. Of the ng pigs, 6 were red, spotted with black, and one black spotted with ite. In the spring of 1917, another litter, produced by mating a pure-bred roc Jersey boar with a pure-bred Berkshire sow, contained 5 young pigs, which 4 were red spotted with black, while 1 was black with the white ts of the Berkshire. The appearance in the 1st. generation of a black nal spotted with white had never been observed in any of the practical periments at the above-mentioned College.

The case being an exceptional one, this black and white female of the (1915) was chosen with one of its sisters from the same litter, and which wed the usual black and red coloration, for use in further experiments. regards the case of the black and white pig born in 1917, the factors heredity have not yet been investigated.

The hybrid white and black sow, born in 1915, was called No. I, and sister No. II. These sows (F_1) were both mated at the age of 1 year with ure-bred Berkshire boar, Rival's Duke XXII 193 411, with the object of ermining if the black and white sow No. I possessed any hereditary fac- for red; sow No. II was used as a control.

Results of Mating.

Parents		Colour of offspring (numbers of cases)			
Boar	Sow	Red and black	Black and white	Red, black and white	Yellow and black
Duroc Jersey 58875	Berkshire 199330	6	1	—	—
Berkshire 193411	Hybrid No. I	1	5	2	1
Berkshire 193411	Hybrid No. II	6	4	4	—

The litter produced by mating the hybrid sow No. I (black and white) th a Berkshire boar showed a greater variation than that given in the abo e ble. At the end of the summer of 1915, the white hair of this sow became llowish, as is usual in the case of white pigs, but in the winter, it again came pure white. At the age of 1 year, however, a narrow yellowish nd appeared between the ears, extending down the back of the neck for om 4 to 6 inches. In the litter of 5 pigs which are described as black and ite, one alone could be termed pure black with white spots. The others d reddish hair round the groin. One pig only was red and black, and this case, the black was dominant, with patches of red bristles. The dominance of black as regards red in F_1 had never been observed by the iter in the F_1 of a Berkshire × Duroc Jersey cross.

The usual arrangement of the colour of F_1 did not appear in the generation when sow No. I was mated with a Berkshire boar. One was light brownish-yellow spotted with black. Two pigs showed distinc the 3 colours black, red, and white. One of these had a black bo with irregular patches of red and white. The other animal had 5 longitudi bands of reddish bristles on a black body spotted with white. The case is interesting, because young wild boars have longitudinal stripes their bodies. This would seem to be an exception to the fact obser by CASTLE (*Genetics and Eugenics*, p. 137), who says that the characte stripes would appear to have disappeared in all domestic races of p which are exclusively black, pink or white, or else black spotted with wh or red spotted with white. The only explanation of these longitudi bands on the body would seem to be, that the determinants of th heredity are not entirely eliminated by improved breeds of pigs.

Given that in the litter produced by sow No. I, eight out of nine of young pigs showed red, or traces of red, coloration, it is evident that sow possessed a chromosome character for the colour red. It has been sta that in Berkshire pigs red is hereditary, but it does not seem reasona to conclude from this case that sow No I did not possess the factors for 3 colours black, white and red.

A litter of 10 pigs were obtained from the mating of sow No. II with same Berkshire boar. The sow had a red body spotted with black. also changed considerably in colour when over 1 year old; the red bris on the abdomen and face becoming a pale yellow. The colour of the ter of sow No. II was more uniform than that of the young of No. I; the pigs being red spotted with black = 4, black spotted with white = 4, dish black with white spots. There appeared to be a reversion in the lour dominance in the cases of sows I and II. In the first, black repla red, as the ordinary fundamental colour, and white spots took the plac the usual black ones of the cross Berkshire × Duroc Jersey. In sow No. which was of the usual fundamental colour, red with black spots, white colouration was recessive or inhibited by some other factor. In case of sow No. I, the factor for the longitudinal bands on the body, wh are found in the wild boar, may have prevented the expression of its factor. The fact that this sow had a narrow red stripe on the back of neck, leads us to suspect that this may have been the case.

Colouration in the other crosses. — The following are the observati made by the writer as regards the colour obtained in the F_1 by crossing different breeds.

1) Berkshire × Tamworth: Red (darker than in Duroc Jersey) spotted with b

2) Berkshire × Duroc Jersey: Red (of various shades) with black spots. (rare) with white spots.

3) Berkshire × Yorkshire: White (uniform) — White with black spots (rare

4) Yorkshire × Tamworth: White (uniform) with reddish shade.

5) Yorkshire × Duroc Jersey: White (uniform) with reddish shade.

6) Berkshire × Chester White: White (uniform) — White spotted with black proportion).

These observations do not confirm the general opinion that the uniform white of the Yorkshire breed is completely dominant as regards the ed of the Tamworth and Duroc Jersey breeds.

HORSES

70 - **The "Beirão" Horse in Portugal.** — MONTEVIO, ANASTACIO, in the *Revista de Medicina Veterinaria*, Year 16, No. 186, pp. 166-169. Lisbon, August, 1917.

The breeding of "beirão" horses was fairly well developed in 1870; t that period, although retrograde, the breed was still plentiful on the isbon market, where it provided nearly all the cab-horses. Afterwards, he "beirão" horse quickly gave place to mule-breeding, and, in 1886, t was only bred in the plateau of Côa.

All the Portuguese horses have the same origin, differences between he various breeds being due to different environment, attention, etc.

The "beirão" horse may be distinguished from the related breeds in outhern Portugal by: its small frame, rarely more than 5 feet high; a eavy fleshy head; badly placed and rather thick ears; squat shape; omewhat coarse hair; very crooked hind joints; a coat where dark colours redominate. Those bred on the plateau of Côa, where they are better ooked after, are better, being more stylish.

The "beirão" horse forms a breed zootechnically distinct owing its rigin to the special environmental conditions, such as: being bred in a ranitic, mountainous, uneven region with the temperature varying round)° C or still lower during more than half the year; total absence of the most imple care and attention, etc.

CATTLE

1 - **Milking by Machinery.** — HOPPER, J. J. and NUTTER T. W., in *The Field Illustrated*, Vol. XXVII, No. 10, pp. 755, 896, 810 and 812. New York, October, 1917.

Since 1913, at the Kentucky Experiment Station, 30 cows a day are nilked by machine. Occasionally, when through some accident to the motor, : is necessary to milk by hand, 2 men can milk the herd in 1 ¼ hours, but nore usually they need 1 ½ hours, or 3 hours a day for the two milkings. Vith a machine the work can be done in 45 minutes, or 1 ½ hours a day, but 'ashing and attending to the apparatus before and after milking require nother 1 ½ hours. An expert workman can milk by hand as quickly as ne machine, which takes 4 minutes to milk a cow, but, with the machine, wo cows can be milked at once, and the milkers prefer the machine.

Mechanical milking is advantageous with a herd of 30 cows, and the rger the herd, the more necessary it becomes. With a herd smaller than o there is less to be gained by the use of a machine.

The four machines at the Kentucky Experiment Station cost $ 568; 1 four years, repairs and new rubber parts have cost about $ 448. The lectric power used costs about $ 3.90 a month or $ 1.56 per cow annually. he combined cost of repairs for the machine and for power amount to 5.31 per cow per year. Possibly a small gasoline engine would decrease he expense.

From data obtained from the Station and from the Elmendorf dairy, here 400 cows are kept, it was seen that the lactation period was extended om 11 to 16 months. Frequently mechanical milking was replaced by

hand milking during 1 or 2 weeks, during which little or no change was noticed in the milk flow. It should be noted that, unless the cows are carefully stripped by hand after machine milking, they dry off very rapidly.

By hand stripping a small quantity of milk, varying from half a teacupful to half a pint, is obtained. Hand stripping has the advantage of allowing the condition of the teats to be observed ; it is carried out while the machine is milking another cow. To obtain perfect results the machine must work perfectly, faulty pressure may do harm, and the presence of blood in the milk may be attributed to it, but it is easily remedied. During 4 years only 5 cows were found which did not take to mechanical milking.

As many as 5 % of the cows in a herd may not be satisfactorily milked with a machine, but the other 95 % are accustomed to it after 2 or 3 milkings. Milk was obtained with as few as 50 to 100 bacteria per cc., and the bacterial count rarely exceeded 2 000 to 4 000. The average bacterial count of station milk published by the Lexington Health Board for July was 500.

The machines are cleaned with warm water, washing powder and a hard brush. The detachable parts are then rinsed and placed in an antiseptic solution. Just before milking, the teat cups and tubes are washed with water. Vigilance and care in cleanliness are absolutely essential both in machine and in hand milking.

The advantages of mechanical milking may be summarised as follows: it makes the work easier and the workmen are better satisfied. It does not decrease the amount of labour required, but makes it less hard.

72 - **Poultry Feeding Tests in New Zealand.** — BROWN, F. C., in *New Zealand Department of Agriculture, Industries and Commerce, The Journal of Agriculture*, Vol. XIV, No. 6, pp. 464-468, 1 fig. Wellington, June 20, 1917.

With a view to finding a substitute for wheat, which hitherto had been generally considered as an indispensable item of a laying fowl's diet, the New Zealand Department of Agriculture, in May 1915, instituted feeding tests at its Milton Poultry Station. The object of these tests was not to aim at high egg records, or high profits over the cost of production, but to ascertain, as far as possible, what results could be obtained by the elimination of wheat from the ration.

The offals of wheat, pollards and bran were included in the dietary.

The 1st. year's tests lasted from May 1, 1915 to April 28, 1916; 4 pens each containing 6 fowls took part : 2 of white Leghorns (pens 1 and 3), and 2 of Brown Leghorns (pens 2 and 4). One pen of each breed had wheat in the ration and the others none.

The 2nd. year's tests commenced on May 1, 1916 and concluded on April 30, 1917. Pens 1 and 3 received the same dietary as in the preceding year in the case of pens 2 and 4, the only alteration was that lucerne-meal was substituted for pollard. It is interesting to observe that the leading pen No. 4, received no pollard or wheat.

Conclusions. — Wheat and even pollard, are not indispensable in the dietary of the heavy layer when oats and lucerne-meal are both substituted.

Hens in their 2nd year, with both wheat and pollard eliminated from the ration, can produce a profitable number of eggs ; meat-and-bone meal

Poultry-Feeding Tests.

No. of pens	Number of eggs laid per pen	Average number of eggs laid per fowl	Food consumed		lbs.	Cost of food £ s d	Value of eggs £ s d
			1st year.				
1	1 428	239	Pollard	Mash	275		
			Bran		103		8 18 7
			Maize-meal		93	4 7 5	
2	1 403	243	Meat-and-bone meal		86		9 0 4
			Wheat		426		
			Pollard	Mash	240		
3	1 443	238	Bran		91		8 16 5
			Maize-meal		93	4 11 8	
			Meat-and-bone meal		85		9 0 7
4	1 449	241	Lucerne-chaff		173		
			Oats		406		
			2nd year.		lbs.		
			Pollard	Mash	133		
			Bran		43		
			Maize-meal		40		
1	950	159	Meat-and-bone meal		17	2 2 0	6 2 8
			Meat-and-bone meal (fed separately)		25		
			Wheat		229		
			Lucerne meal	Mash	104		
			Bran		43		
			Maize-meal		36		
2	1 079	179	Crushed wheat		71	2 2 5	7 0 7
			Meat-and-bone meal		20		
			Meat-and-bone meal (fed separately)		23		
			Wheat		189		
			Pollard	Mash	112		
			Bran		38		
			Maize-meal		40		
3	1 042	173	Lucerne-chaff		82	2 2 0	6 12 2
			Meat-and-bone meal		21		
			Meat-and-bone meal (fed separately)		22		
			Oats		202		
			Lucerne-meal	Mash	110		
			Bran		40		
			Maize-meal		36		
4	1 211	201	Crushed oats		77	2 3 9	7 13 10
			Meat-and-bone meal		21		
			Meat-and-bone meal (fed separately)		27		
			Oats		192		

makes a good substitute for boiled meat. The quantity of meat-meal eaten is largely influenced by the number of eggs laid. This is indicated by the quantity of meat-meal consumed by pen 4 (See Table).

A large quantity of meat-meal can be consumed by heavy-laying stock without injurious effects such as ovarian troubles, provided the meal is chiefly supplied in a separate hopper and kept always before the birds for them to pick at.

Lucerne-meal is preferable to the chaff-hay form of lucerne as an egg-producer, and also as a labour-saver, steaming over night being unnecessary.

73 – **Turkey Rearing in Italy.** — CASTELLARI, A., in the *Gazzetta Agraria, Commerciale Industriale, Organo del Consorzio delle Cattedre Ambulanti di Agricoltura per la Provincia d'Alessandria*, Year 1, No. 21, pp. 141-142. Alexandria, Italy, November 15, 1917.

Among the chief breeds of turkey (Norfolk black, Cambridge buff, common black, English white, bronze), the best is the bronze, especially for its early maturity and weight producing qualities (on an average 35 lbs. for the mature, and 24 lbs. for the young turkey, cock; 25 lbs. for the mature hen and 15 for the young hen). Crosses have been made, particularly at Ravenna, between the white English breed (delicate flesh, but not so hardy as the common black) and the common breed, and excellent results have been obtained. The common turkey hen produces about 40 eggs a year if she sits; if she does not, double the number may be laid. The hen can do three successive sittings of 30 days each without any harm if given abundant food; according to her size she can sit 20 to 24 eggs, so that in 90 days, from 60 to 70 turkey-chicks would be obtained per turkey-hen.

The writer gives the following rules for feeding:

No food to be given for the first 48 hours after hatching.

First food: bread (even of maize) soaked in skim milk, mixed with 1 hard egg for 5 chicks and a finely chopped onion.

Ten days after hatching, flour mash (maize, rye, etc.) mixed with finely chopped chicory, nettle and onions.

At about 1 month, a pinch of pepper should be added to the mash.

At 2 months, always give cooked food, divided among 4 meals a day; later, 2 meals will suffice.

During the critical period in rearing turkeys, seeds of hemp, flax, millet, rye, oats, wheat, *well cooked*, should be preferred, as well as stale bread and waste meat; add a little pepper and chopped onion.

In fine weather, the flock should be sent to pasture.

During fattening, which begins a month before sale, the time spent out at pasture must be decreased, and well varied food given, always cooked and salted; thus, give mash in the morning and grain in the evening (oats are very good).

The following daily rations suffice for 20 turkey chicks; the total cost of the first 2 is about 2 1/2 *d.*; that of the 3rd about 2 *d.*; they are most suited for seasons when other fresh food is lacking.

1. — Maize flour, 4 parts; sesame cake, 4 parts; Oats, 2 parts (cooked and salted); — *total weight*, 2.2 lbs.

II. — Cooked potatoes, 8 parts; sesame cake, 4 parts; rye, 3 parts (cooked and salted): *dal weight*, 3.2 lbs.

III. — Kitchen waste, cooked potatoes, 6 parts; maize flour, 4 parts (cooked and salted): *dal weight*, 2.2 lbs.

The common breed, when suitably fattened, will reach the following ghts: male, 20 to 22 lbs.; female, 11 to 13 lbs. An 11 lb. turkey-hen will : 62.5 % of meat; 8.5 % of bone; 4 % of fat; 6 % of feathers; 19 % of od, viscera, etc. Turkey flesh contains, on an average: 55 % of water: % of nitrogenous matter; 22.9 % of fat; 1 % of ash.

Three hens and a cock were kept by a small household; 120 turkey-ks were hatched, of which 90 lived and were reared.

The accounts were made up as follows:

EXPENSES.

Upkeep of 3 hens	19 s.
Upkeep of 1 male	6 s. 5 d.
Upkeep of the chicks for the first 3 months	120 s.
Cost of guarding while at pasture	60 s.
Cost of fattening, at 1s. 2 1/4 d. per head	108 s.
Total Expenses	313 s. 5 d.

RECEIPTS

90 turkeys, averaging 15 lb. each, *i. e.* 1 350 lbs. at 13.4 *d.* per lb.	1 123 s. 2 d.
Manure produced at 9 1/2 *d.* per head	71 s. 3 d.
Total receipts	1 195 s. 5 d.
Total profit 1 182 s. or £ 180 2 s.	

– Transmission of Richness in Silk and Hardiness in Crossing Silkworms. – GRANGEON, F., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, pp. 888-891. Paris, October 10, 1917. SERICULTURE

The author (ex-director of the sericultural Station of Nanisana, Madagar) points out that, in tropical countries, it is essential to rear hardy ds, as the methods of the natives are not sufficiently careful and larvae, ll ages have to eat a mixture of young and old mulberry leaves, owing he method by which the tree is cultivated. They also have to bear a high temperature and a moist atmosphere.

There are very hardy breeds, especially in Bengal, but the larvae, which quite small, only give a cocoon with a very thin covering of silk.

It seems impossible to combine the two characters *hardiness and rich- in silk*. In Bengal very clear results were obtained on the transsion of these characters to the products obtained by crossing native ds with improved European and Madagascar breeds.

In all the crossings the silk-worms of the 1st. generation distinctly e the hardiness of the mother and those of the 2nd. and 3rd. generations rdiness intermediary to that of the father and that of the mother. The ae of the following generations gradually divide up into small, resist- larvae and large larvae with but a slight resistance which die out.

In all the crossings the larvae of the 1st. generation have the richness

in silk (if anything slightly increased) of the parent, male or female, whi is richest in silk. Those of the 2nd. and 3rd. generation have a richn in silk rather inferior to that of the 1st. generation, then individuals i in silk gradually die out in the following generations. The dying out these worms is caused by the climate and does not occur if the crossings made at such an altitude as to attenuate the effects of the climate.

These facts show that crossing a Bengalese female with a male of i proved breed would give, in the first generation, silkworms having t hardiness of the Bengal breeds and the richness in silk of the Europe ones. Cocoons rich in silk would thus be obtained in a climate fatal improved breeds. The two following generations might also give satisfact results during a good part of the year.

The difficulty is to obtain, at the requisite moment, males of impro breeds, which must be kept pure. Moreover, if the larvae hatch out in the first generation, it is a different matter in the following generati when a polyvoltin is crossed with a monovoltin. All these difficul may be overcome if there is a mountainous district near enough, which not require a journey of from 10 to 12 days (as is the case in Madagasca In the mountains of tropical countries where the altitude is sufficient to ma the climate temperate it is easy to obtain improved polyvoltin bree throughout the year. Moreover these breeds may always be obtained crossings (followed by selection) between European monovoltins a polyvoltins of tropical countries.

75 – **The Appearance of "Accidental Bivoltins" in Univoltine Breeds of the Si worm.** — LECAILLON, A.: I. On the Appearance of "Accidental Bivoltins" in Univ Breeds of the Silkworm and the Explanation of this Phenomenon, in *Comptes Re des Séances de l'Académie des Sciences*, Vol. CLXV, No. 18, p. 603-605. Paris, Oct 1917. — II. On the Special Characters Shown, at Various Stages of their Develop by "Accidental Bivoltins" appearing in the Mulberry *Bombyx*. *Ibid.*, No. 20, p. 6 Nov. 12, 1917.

I. — "Accidental bivoltins" are 2nd. generation silkworms someti found among univoltin breeds. The author gives the following result the observations and experiments he has carried out on this supplement generation, observed for a long time by breeders :

1) In 1917, the univoltin breed, studied since 1914, gave 3 case bivoltism.

The first was that of the pair which matured earliest, and appeare June 18. The fertilised eggs of this pair began to hatch 10 days after b laid (a fact which, normally, should only occur after 9 ½ months). Al 400 eggs were laid by the female, 377 of which produced larvae and a only remained at the customary stage of normal univoltin eggs which h nate ; 10 larvae died in the eggs.

Two other females, born on June 21 and 27, whose copulation prevented, laid eggs, some of which produced, a few days after being larvae which died as soon as they hatched (1).

(1) On the subject of parthogenesis in the silkworm, see *R.* October, 1917, No. 95 *R.* November, 1917, No. 1050. (*Ed.*)

2) In order to see whether temperature could cause bivoltism, experiments were made in which the cocoons, then the moths and eggs, of a univoltin breed were placed in a special room, the temperature of which was always kept at 25 to 30° C., *i. e.*, some degrees higher than that at which the eggs are usually laid. There were no bivoltins.

3) It seems that the appearance of bivoltins may be explained as follows :

a) The embryos, larvae, chrysalides, and moths from different eggs laid by the same female mated with a single male are far from being identical either from a morphological or physiological point of view. The time required by the embryos to form within the egg especially, is very inconstant. The remarkable difference between various individuals of the same parents is due to the fact that the ovules of a single female are no more identical with each other than are the spermatozoa of a single male.

b) Direct action of environment is not the determining cause of accidental bivoltism.

c) It is known that the action of cold, high temperature, brushing, electricity, and acids will cause ordinary univoltin eggs to hatch prematurely. In the production of accidental bivoltins, however, it is only a question of the direct and prolonged influence of the breeding conditions which acts on the composition of the eggs which are being formed, and doubtless also, on the developing spermatozoïds.

d) In the author's experiments, the eggs kept for reproduction remain, during the first 3 months after being laid, at a temperature which is often as high as 30° C. During winter the temperature is not below 5 or 6°. It is probable that, under these conditions, the univoltin embryos are so influenced that those which already have the capacity of transforming rather quicker than the others, have this tendency accentuated. From them are descended, in the following spring, moths whose progeny is more or less entirely accidentally bivoltin.

Finally, the author points out that this phenomenon must be gradually more marked in rearing if, from year to year, the moths which appear first are used for breeding,

II. — " Accidental bivoltins " seem to represent an important step in the scale of the changes that a univoltin breed may undergo to form a well defined bivoltin one, and, in order to help comprehension of the variations produced in the species during centuries of rearing under different climates and which may still be produced, the author gives the special characters of the bivoltins appearing in his rearings at all the stages of their development.

a) The eggs of the 3 layings where the author observed cases of accidental bivoltism were so poor in yellow colouring matter that they appeared almost completely white. Their chemical composition was, therefore, different from that of ordinary univoltin eggs. Consequently, the conditions of rearing, when they cause the production of accidental bivoltins, first cause changes in the chemical composition of the egg, particularly of the vitellus.

b) During the embryonic development of the accidental bivoltins, the colouration of the egg changes only slightly, owing to the small amount of colouring matter present.

c) Contrary to the general belief, the author is of the opinion that most accidental bivoltins can be easily reared, breeding being normal, and that these larvae are no more subject than ordinary univoltins to the diseases, etc., that commonly attack *Bombyx*.

d) The author has noticed no particular difference between accidental bivoltins and normal univoltins in their other stages, *i. e.*, as chrysalis and perfect insect. Copulation and oviposition were quite normal; the number of eggs laid by accidental bivoltin females corresponds with that laid by ordinary univoltins.

76 – **Methods of Identifying Silkworm Eggs Made Bivoltin by the Action of Hydrochloric Acid; Investigations in Italy.** — Acqua, C, in *Rendiconti dell' Istituto bacologico della R. Scuola di Agricoltura in Portici*, Vol. II, pp. 75-77. Portici, 1917.

Of recent years there has been a large demand for silkworm eggs for the summer-autumn rearing. Among the treatments to which the eggs are subjected to make them hatch prematurely are immersion in a suitable dilution of hydrochloric acid and exposure to " electric rain ". It sometimes happens that there are put on the market eggs said to have been treated electrically which, in reality, have only been subjected to the hydrochloric acid bath. The deception may be discovered by the following characters of eggs treated with hydrochloric acid:

1) Dark brick-red colour inclining to a violet, almost wine, shade the eggs remain this colour till just before they hatch, when they turn pale finally becoming the same colour as ordinary eggs.

2) Complete removal of the sticky layer which envelops the eggs in the natural state and enables them to adhere to objects and each other Silkworm eggs treated with hydrochloric acid are not sticky and may easily be run through a narrow funnel.

These characters are common both to the native yellow and Chinese breeds and to crosses between them.

Eggs treated electrically do not change colour, but only become a little less dark and their colour is indistinguishable from that of other eggs with which they are compared. There is no effect on the sticky layer.

77 – **" Akino-nogeshi " (*Lactuca brevirostris*), A New Silkworm Food Recently Discovered in Japan.** — *Le Moniteur des Soies*, Year 55, No. 4870, p. 2. Lyon, December 8, 1917.

Mr. Fujima Daijiro (chief of the Oi branch of the Silkworm Institute of the Gifu Prefecture) has recently discovered that a plant " akino-nogeshi " (*Lactuca brevirostris* Champ.), is probably not inferior to the mulberry in silkworm feeding. He obtained excellent results with this food; larvae fed on it from the first stages gave, if anything, better cocoons than those fed on mulberry leaves. This discovery is of great value in districts where frosts injure the mulberry trees. As the plant in question is hardy and will it can be left to grow in the mountains or plains without any special care being given it.

– Carp-Breeding in Transplanted Rice Fields: Experiments at Vercelli, Italy (1). — MARCARELLI, B., in *Il Giornale di Risicoltura*, Year VII, N° 19-20, pp. 218-253. Vercelli, October 15 and 30, 1917. FISH CULTURE

It is especially due to the " Società vercellese di agricoltura " that, r some 3 years, carp breeding is spreading in the rice fields of the province Vercelli. Although this new industry has not yet passed the experiental period, yet it has given very encouraging results. It should be reembered that, besides its value, the carp is an excellent help in combatting alaria, and destroying weeds by eating their seeds (Prof. SUPINO has found eds of *Glyceria Polygonum*, *Cyperus* and *Chara*, etc., in the intestine of ie carp), as well as hindering their germination by agitating the surface the soil.

The rice-growing Station of Vercelli has done much propaganda work r rice-growing by transplanting (2) ; this is why the Station advocated the ial of carp-breeding in transplanted rice-fields. Towards the end of June, 17, mirror-carp fry, from Galicia, were placed in two plots of the Station's perimental field, each plot measuring about 6000 sq. yds. On July 11, 0 small carp, each weighing from 16 to 19 gm. were added to the fry in ie of the plots. Nothing further was done, save to regulate the water pply. On August 26, the water was drained from the ricè fields and, 2 ys after, the fish were collected and found to weigh from 150 to 180 gm. r the fry and 300 gm. for the small carp. The fish were put in a pond for ie winter.

The writer concludes from these results that carp breeding in transplanted rice fields is possible if fry or young fish of 1 or 2 summers are used. n the other hand, the use of mature fish cannot be advised, seeing that ie season is too far advanced when the water has to be run into the rice elds (about mid-June). In comparison with the directly-sown rice field, ie transplanted rice field offers the following advantages : — freeer and uicker circulation for the fish, giving easier feeding and quicker growth ; ie possibility of always keeping a constant supply of water ; greater savg of special work such as ditching, etc. The presence of carp in the transplanted rice field causes no damage whatever, especially if the precaution e taken, when small carp of 1 or 2 years are used, of not putting in the fish ll 10 or 12 days after transplanting, that is, when the plant is well rooted.

– The Amazon Turtle as a Producer of Eggs, Meat and Fat. — TAVARES, J. S., in *Broteria, Serie de Vulgarisação Scientifica*, Vol. XV, Fasc. VI, pp. 270-283, fig. 2. Braga, November, 1917. OTHER LIVE STOCK

Turtles are extraordinarily abundant in the Amazon and its tributaries. he true turtle (*Podocnemis expansa*) is adult at about 10 years old ; it is hen about a yard long ; the dorsal carapace will measure about 31 inches, hile the body weighs from 26 to 33 lbs. As the carapace has no horny ales, like those of the marine turtles, it is of no commercial importance. he eggs and meat are utilised, however.

(1) See also : F. SUPINO, Carp-Breeding in Rice Fields in Italy. *B.*, September, 1913, 1332-1335. — (2) See *B.*, 1915, No. 271. (*Ed.*)

At the egg-laying season, the turtles appear in hundreds on the bank of the river and dig pits about a foot deep and 2 to 3 ft. wide, in which after about a fortnight, from 60 to 140 white and almost spherical eggs are laid. The females fill up the holes with earth, which they afterwards smooth over to hide the place. Incubation is by the heat of the sun ; shortly the young turtles appear and enter the water in search of food.

The natives ("caboclos") hunt for eggs, testing the ground with a stake, until a hollow sound is obtained. The eggs are equally eatable whether raw or cooked. By a very crude process, the natives extract a fat called "turtle butter" from the eggs, to use as food or for burning. The fat is sold in tins of about 40 lbs. at an average price of 11 *milreis* (24s. 8d at par). The turtle butter is mostly prepared in the regions of Upper Amazon, Jurna, Tefé, Rio Negro, Purus, Yutahy, Madeira, Solunões and Javary ; thousands of pound's weight are sent every year to the market at Belem de Para.

Tortoise meat forms a great part of the food of the poorer classes ; that of young animals is more appreciated, thus costing more. Living turtles are often sent to Europe, where the meat, particularly used for making soup, constitutes a very delicate dish.

The turtles are captured either by hand, by shooting with arrows, with hooks, or with nets.

When the turtles are wandering along the banks of the river at egg-laying time, the natives chase them and turn them on their backs. They are then quickly (10 to 15 minutes exposure to the sun suffices to kill them while on their backs) taken in canoes and kept alive in water, in enclosures called "currales" surrounded by stakes to prevent them from escaping. The turtles are kept thus until sold or eaten. The price of an adult turtle formerly very low, now varies from 5 to 20 *milreis* (11s. 3d to 45 s. at par). In addition to the true turtle (*Podocnemis expansa*), the natives on the river banks of the Amazon also hunt other Chelonians, such as ; the "tracaja" (*Podocnemis dumerihana*) ; the "kâgado da matto" (*Rhinemys nasuta*) ; "jabuty machado" (*Platemys platycephala*) ; "jabuty aperema" (*Nicoria punctularia*) ; "matamata" (*Chelys fimbriata*) ; and the "mussuan" (*Cinosternum scorpioides*), very abundant in the island of Marajó.

FARM ENGINEERING.

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80 – **The Tractor in Relation to the Farm and Its Machinery.** — KRANICH, F. N. in the *Transactions of the American Society of Agricultural Engineers*, Vol. X, No pp. 101-108. Ames, Iowa, March, 1917.

According to the writer, there exist, between the tractor and its environment, relations of three types :

1) Relations to draft machines ;

2) Relations to belt-power machines ;

3) Relations to the economics of the farm.

These factors are all equally important, but, unless the tractor's u ty can be divided equally among them, it is not a success on the farm.

Draft machines. — Considering the actual horse power required, plough-
g constitutes the heaviest work of farming, though not the longest in
tual hours of work. Milking requires at least an hour morning and even-
g for one man, which totals to 73 days of 10 hours per year. Ploughing
the average farm requires less than 20 days per year. Farmers often
nsider tractors as merely ploughing machines ; to this end the horse drawn
ng ploughs have been adapted for use with tractors, as the other farm
aft machines will probably be. The disc harrow, the spring tooth harrow,
d crusher, etc., are best used right behind the plough.

Most of these machines are usually drawn by 2, 3 or 4 horses ; too much
wer would be wasted were they hitched alone to the tractor. Several
these machines should be combined, or one large machine should be con-
nected, to form a sufficient load for the tractor.

But it remains to be seen if that is desirable, for each binder or mower
uld require a man, so that the measure would defeat its usefulness.
reover, the extra expense of these machines would cost too much per
it of production. Again, the small tractor is limited in power, and the
e of farm for which it is suited would not require 2 or 3 binders, mowers,
harvesters. Drawing a manure spreader, a tedder or rake is ordinarily
rk for 2 horses. The tractor's relation to either of these machines is
estionable. The tractor can, of course do this work, but is it economical ?
spreader is empty half the time and then is not even a load for a 2-horse
m. To draw 2 or 3 spreaders by a tractor might not be economical,
account of the time lost in loading, hitching and handling. Harrows,
nure spreaders, etc., might be adapted to tractors, but it would increase
e machinery cost to the farm, as well as necessitating changes to provide
commodation for them. Would this be considered economic farming,
d would the method lower the cost of production ? In the next few years,
e tractor will certainly reach such a stage of development as to render it
ll more useful. Farm machines will be built in sizes to suit economical
rking of the tractor and they will be of better design and construction.
e tractor does not need to replace all the farm horses, but it must replace
ne to prove its economic value. If the tractors replaces horses of value
ual to twice its cost, it has served a great part of its intent.

Belt-power Machines. -- The tractor should be able to drive the belt
power machines of the farm ; but the tractor and the machines (grain
parator, huller, saw, etc.) should be so arranged as to work at the maxi-
um capacity consistent with efficiency. Convenient belting should be
ovided as well as proper speeds without unnecessary pulley-changing.
tractor suitable for belt work only would not be considered an economic
m machine. It is probable that few of the gas or steam tractors used
the United States represent a profitable investment for their owners, for
ey remain idle so much of the year, because belt work, primarily threshing,
is their purpose.

It is the variety of things done economically by the tractor during the
ar that makes for its close relationship to the farm and its machinery.
belt work is the principal aim, the portable engine will solve the problem

at half the cost of a tractor, for most of the expense of the tractor lies its transmission parts, which are for draft work.

Farm Economics. — The economic relation between the tractor and the farm in general is very important. Although closely related to the draught machines and power machines, the tractor may prove rather an expense than a saving, if it is not in proportion to the whole farm. Thus, an 80-acre dairy farm, with 5 horses, would obtain no economic advantage from the purchase of a 15-30 HP. tractor, which, although of first-class construction, would be more suited to a 600-acre farm.

The tractor will bring about a new era in farm machinery. Its value is only just beginning to be recognised. Farm machinery will be redesigned to meet the needs of tractor farming, as well as being constructed to give better and longer service. At present it is often of poor quality. It should work more efficiently, have a longer life, which would give better profit and reduce the unit cost of production.

81 – **Machine Cultivation Tests at Noisy-Le-Grand, France** (1). — RINGELMANN, M. in *Feuilles d'Informations du Ministère de l'Agriculture*. Year 22, Nos. 39 and 40, pp. 7-9 and 12-13, tables 7. Paris, September 25 and October 9, 1917.

The author's second report on the trials at Noisy-le-Grand (France) deals with 12 machines indicated in the appended Table, which summarises the results of the work carried out.

As a supplement to the special trials in 1913-1914, 1915, 1916 and 1917 (which concerned 63 machines) the writer formulated a number of conclusions, the chief of which are given below.

The weight of the tractors should not be more than 6160 to 6600 lbs. Such machines are easy to handle and give an average tractive effort of from 1320 to 1540 lbs. Above such a tractive effort, the machines do not last long, the axles are strained, thus resulting in greater wear and tear, with a reduced length of life.

When the work (breaking-up or deep ploughing) requires a tractive effort of more than 1320 to 1540 lbs., recourse should be had to a wheel tractor.

To provide for good steering, about one-third of the total weight should be carried by the steering wheels and two thirds on the driving wheels. Two steering wheels are more effective than a single one.

The weight of the tractor in relation to the width of the wheels should not be more than 170 to 180 lbs. per in. of tyre width (figure obtained and checked at the trials). Neither the width of the tyres nor the diameter of the driving wheels (43 to 55 ins.) should be increased too much.

In the case of exterior transmission to the driving wheel or wheels (gears or chains) a clearance of at least 10 to 12 ins. should be left between the ground level and the lowest point of the drive or gear box.

A differential should be dispensed with, one driving wheel or 2 driving wheels placed close together being used instead. With one driving wheel working in the furrow and the other on the unploughed land, the strain fa-

(1) See *R.*, November 1917, No. 1051. (*Ed.*)

Results of the Ploughing Trials.

Machines	Fuel	Stated H. P.	Sale price without plough	Number of order	Ploughing: Depth	Ploughing: Width of work	Average speed per hour	Average time for turning	Time required to plough 1 hectare	Surface actually ploughed per hour	Fuel consumed: per hour	Fuel consumed: per hectare	Tractive effort: Average total	Tractive effort: Average per sq. dm.	Average speed of the plough	Tractive effort at draw-bar: kg. metres per second	Tractive effort at draw-bar: H. P.
			francs		cm.	metres	metres	second	hr. min.	sq. metre	kg.	kg.	kg.	kg.	m. per second		
J) Gray	Petrol	25	25 000	25	11.8	1.45	3 810	30	3h 36m	3 840	9.81	25.5	1 177.1	68.8	1.06	1 247.72	16.63
				26	16.2	1.45	3 060	30	3h 09m	3 174	7.84	24.3	1 517.4	64.6	0.85	1 289.79	17.19
K) Bull	»	20	11 000	27	10.8	0.95	4 032	20	3h 34m	2 802	4.52	16.2	—	—	—	—	—
				28	15.3	0.95	3 492	20	4h 3m	2 472	4.79	19.1	—	—	—	—	—
				29	18.2	0.64	3 999	20	5h 21m	1 872	4.84	25.6	—	—	—	—	—
				30 bis (1)	7.0	2.50	4 212	20	1h 18m	7 080	4.08	5.3	—	—	—	—	—
L) Chase	»	16	15 000	31	9.2	1.05	1 944	40	6h 45m	1 482	4.04	27.0	633.4	66.2	0.54	342.03	4.56
				32	13.0	1.04	2 268	40	5h 54m	1 692	4.25	25.0	666.2	51.5	0.63	438.60	5.84
M) Amanco	Paraffin	24	12 500	33	12.3	1.04	1 672	30	8h 44m	2 676	6.58	24.3	726.4	56.8	1.02	740.92	9.87
				34	13.6	1.09	3 420	30	3h 46m	2 652	7.12	26.3	871.4	58.8	0.93	827.83	11.03
N) Perroquet	»	25	17 000	35	14.8	1.00	3 780	25	3h 42m	2 700	8.68	32.1	930.0	62.9	1.05	979.50	13.02
				36	16.2	1.05	3 672	20	3h 20m	2 868	11.8	38.7	1 020.6	60.0	1.02	1 041.01	13.88
O) Heureux-Fermier	Petrol	16	9 500	(2)	—	—	—	—	—	—	—	—	—	—	—	—	—
P) Tank	»	35	22 000	(2)	—	—	—	—	—	—	—	—	—	—	—	—	—
Q) Case	»	18	13 500	37	17.1	0.73	3 816	20	5h 12m	1 020	4.45	21.8	553.7	43.0	1.00	580.92	7.82
				38	21.0	0.76	3 744	20	4h 47m	2 088	4.84	22.9	853.8	53.5	1.01	897.95	11.84
R) Globe	»	18	12 000	39 (3)	5.5	1.56	3 492	40	2h 45m	3 030	5.32	14.3	951.2	75.9	0.97	931.06	8.42
S) Blanchard	»	4	(4)	40	14.5	0.26	1 980	60	28h 11m	355	0.92	25.0	239.4	63.5	0.55	131.67	1.75
T) Dessaules	»	10	(4)	41 (3)	2.5	1.56	3 600	40	2h 41m	3 720	2.25	6.0	335.0	85.9	1.00	335.0	4.46
U) Galardi and Pattuzzo	»	6	7 000	42	9.7	0.54	1 872	40	13h 45m	730	2.03	40.1	—	—	—	—	—
				43	14.0	0.32	2 196	40	19h 47m	595	3.17	92.7	—	—	—	—	—
				44	15.6	0.32	2 196	40	19h 47m	595	3.79	75.0	—	—	—	—	—

(1) The tractor towed, on freshly turned soil, a 48-tine harrow weighing 90 kg. — (2) Ploughing tests could not be carried out. — (3) The tractor towed a 13 flexible-tine harrow on the ploughed land. — (4) First machine built; no price yet fixed. — N B. The machine *S* is a double-bratsunt plough, on the fore part of which are fixed a small motor and two hauling winches.

constantly on one side of the differential, one of whose gears wears more quickly than the other.

As regards grips fixed to the driving wheels strakes of various forms damage the ground much less than grouts and other types of grip which tend to pack the soil.

The strakes should run on the unploughed ground; turning the last strip of ground destroys the compressed part, which does not take place when one of the driving wheels runs on the furrow-bottom; in this last case, the packed parts covered in ploughing remain unchanged in hard blocks; this difficulty does not occur in sandy soil. One driving wheel may run in the furrow, but it is inadvisable.

Motors of 20 to 25 HP., with several cylinders of the automobile type and running at high speed, are preferable.

The circulating pump should be gear-driven, while the fan should be driven by a belt.

Endless-track devices (caterpillar treads) should be avoided on account of the difficulty of steering and the rapid wear of the many articulations.

The front-bogie tractors act almost like motorploughs; steering the driving wheels is difficult on account of their weight on the soil, especially if one wheel, provided with grips, runs in the furrow. The steering of the wheelbarrow type of motor plough is also difficult.

The double-brabant windlass plough, which has been largely tested, is of interest for average cultivation.

With a pull of from 1320 to 1520 lbs., an average speed of 3250 yds. per hour seems suitable; the speed may be increased up to 4300 yds. per hour, but on further increasing it, steering becomes difficult and the traction of the implement becomes too heavy. Under similar conditions of work, period, soil, plough, the tractive effort increases from 100 to 118 when the speed increases from 1 to 2.5

The use of the tractor is best suited to furrow lengths of not less than 500 feet. The time required for turning is about ½ a minute (20 secs. with a good driver, 1 minute with an unexperienced man).

Two men are required: 1 mechanic on the tractor and an ordinary assistant on the implement being towed; this latter does not exclude automatic lifting.

More than 50 minutes of actual work per hour cannot be relied upon.

A traction buffer should be placed between the tractor and the implement being towed. In this way an economy of 33 to 54 % is gained on the starting-pull and 19 to 30 % on the average tractive effort, which only affects a part of the hourly consumption of the tractor while reducing the wear of the machinery.

It is worth while hitching a harrow to the plough for ploughing before autumn sowing and for that of spring.

The great advantage of the tractor, resulting from the area it can cover per hour, is that the farmer can immediate utilise the favourable opportunity for ploughing.

The tractor is used to best advantage on furrow lengths of from 3250 to)0 ft., in fields with slopes of not more than 7 or 10 %.

Travelling by road should be reduced as far as possible, unless the grips : removed from the driving wheels, and other precautions taken.

– **Machine Cultivation Trials at Bourges, France, in 1917.** — DESSAISAIX, R., in the *Journal d'Agriculture Pratique*, Year 81, No. 23, p. 150. Paris, November 15, 1917.

The departmental Syndicate for machine cultivation of Cher has car- d out ploughing tests with tractors in September 1917, near Bourges, ance. M. E. RABATÉ, Director of agriculture for the department of Cher, ted the following results :

Tractor	HP.	Average depth of work, in cm.	Area ploughed per hour, in sq. metres	Petrol used per hectare, in litres	Cubic metres of earth turned per litre of petrol
gul.	16	17.2	2 614	23.30	73 8
an	20	19.0	3 528	21.25	89.4
e	20	17.0	2 925	28.23	00.2
ry.	16	18.5	1 707	21.15	87.1
erson	20	18.0	2 604	32.90	54.7
y	30	17.0	3 255	27.20	62.5
line	12	17.0	2 092	29.00	58.6
be.	18	57.0	2 196	43.90	38.7

In these trials the furrow length varied between 728 and 998 ft.

The Case, Avery, Moline and Globe tractors each towed a 2-furrow ugh ; the Mogul, Titan and Emerson tractors towed a 3-furrow plough ; ile the Gray tractor towed a 4-furrow plough.

– **The Cost of Fuel used by Tractors for Ploughing, in Canada.** — ATWOOD, CHARLES V., in *The Canadian Thresherman and Farmer*, Vol. XXII, No. 10, p. 32. Winnipeg, Canada, October, 1917.

The writer has used a kerosene-burning tractor of 8-16 HP. on a 0-acre farm for all cultivation work and for working a hay-press and a op-cutter.

The tractor worked 67 days during a period of 3 months ; the number working hours was 403, or 6 hours a day.

The work was done on a heavy loam soil, where 3 ploughs are a maxi- am load for the tractor used (a small size one), and where, without a od operator, 2 ploughs could be handled to better advantage and less erload to the engine at moments of extra stress. The costs per acre e given below.

In the spring cultivation the tractor pulled two 8-ft. disc harrows and o-ft harrow.

To work an acre required 38 minutes, the cost for fuel and lubrica-

tion being 18 ½ cents per acre. Very few repairs were necessary dur
the first year of operation.

Work.	Cost of fuel and lubricant per acre.	Time required per acre.
Spring ploughing (maize stubble)	$ 0.27	1 hr. 12 min.
» » » » (clover sod) .	$ 0.31	1 hr. 24 min.
Early autumn ploughing (oats stubble) . . .	$ 0.27	1 hr. 9 min.
Late autumn ploughing (oats stubble) . . .	$ 0.30	1 hr. 11 min.
Late autumn ploughing (wet, maize stubble).	$ 0.40	1 hr. 30 min.
December ploughing (clover sod)	$ 0.36	1 hr. 42 mins.

84 – **The "Motoculteur", Built by the "Société La Motoculture Française".**
FREMIER, VICTOR, in *Le Génie Rural*, Year 0, No. 69, New Series, No. 9, pp. 1-5, fig
Paris, 1917.

The "Motoculteur" (1), which took part in the Noisy-le-Grand tri
is the 30 HP. 1917 type embodying all the latest improvements.

The frame properly so-called is formed by what might be called

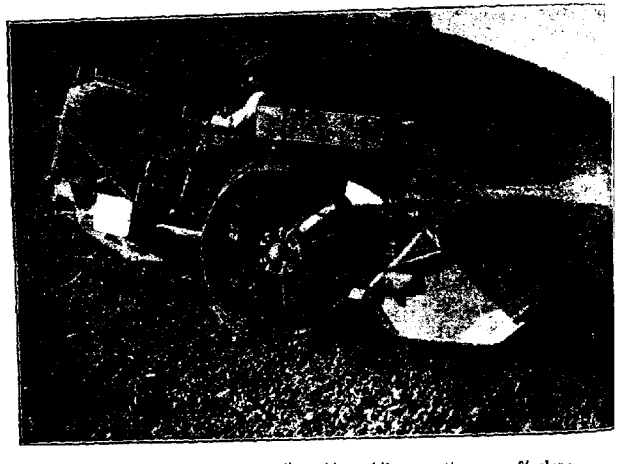


Fig. 1. — The "Motoculteur" working while mounting a 11 % slope.

1) In the *Notes de Culture Mécanique* by DR. CHAUVEAU (Librairie Baillière, Paris, 19
there are described 4 types of "Motoculteurs" constructed by the Société LA MOTOCU
TURE FRANÇAISE, Boulevard Hausmann 41, Paris. These types are: 1) Maraîcher; weig
440 lbs.; 4-5 HP.; price, £ 80; 2) Vigneron, weight, 3 300 lbs.; 16 HP.; price, about £
3) for large scale work; weight, 4 400 lbs.; 30 HP.; price, £ 640; 4) for large scale wo
weight, 5 060 lbs.; 40 HP.; price £ 600.

elly " of the machine, which contains and protects the machinery work- ; in a bath of oil. There is no external greaser. The total length of the ichine is 13 feet, the width being 5 ft. 3 in. The machine (fig. 1) is car- d on two driving wheels and a single steering wheel ; it is very stable as e centre of gravity is very low, being situated a little forwards of the driv- ; wheels. The latter are of 47 in. diameter, and are placed at a point of the total length. The motor is 4 cycle, 4 cylinder and gives, at 1000 1250 revolutions, from 30 to 35 HP. (bore 90, stroke 170) ; it is provided :h a governor. The carburettor includes an automatic air-filter ; the l consumed is 0.4 litres per HP.-hour ; the tank holds 60 litres. e magneto is enclosed and completely protected from dust. There is friction coupling and 4 gears giving speeds of 15, 25, 36 and 59 inches second respectively, as well as a reverse.

As is shown in fig. 2, the rotary apparatus of the " Motoculteur " is ced behind ; there are 2 speeds (150 and 180 revs.) which allow of

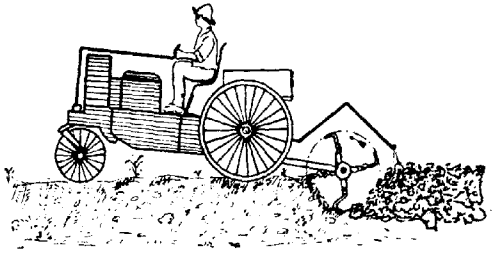


Fig. 2. — Diagrammatic side-view of the " Motoculteur " showing the rotary apparatus.

gulating the work according to the soil and the type of tilth that is quired. The transmission to the apparatus is by a central, universal joint ive.

The machine turns in its own length (in a circle with a radius of less an 10 ft.) and, having no differential, turns on the free interior driving- heel. The machine guides itself when travelling in a straight line, so at the driver can descend from the machine, if necessary, and walk along- le to examine the work, etc. The 1917 type of " Motoculteur " can per- m two functions: 1) by means of its extensible rotary apparatus, work the il completely, producing a *uniform tilth over all the layer worked* in a single urney and in widths of from 59 to 71 ins.; 2) without its rotary apparatus, ork as a tractor, towing all the usual farm implements, including multiple row ploughs or digging brabants.

The rotary apparatus, tearing at the soil in the direction of movement

can, even in a loose, damp soil, ascend with its ordinary wheels slopes more than 15 %, when fully working.

On the other hand, when used as a tractor, removable strakes giving good grip are provided for the driving wheels ; in addition, when its norm weight does not exceed 4000 lbs, extra weight can be given by means sacks of earth or lead bars of 1100 to 2200 lbs. In this state the machi gives, in suitable ground, a draw-bar pull equal to 50 % of its total weig or 1980 to 2640 lbs. The gears are designed for such strains.

Thanks to its lightness, the machine can work with its rotary appa tus in all fields, even on deeply ploughed land, with a single turn, and can prepare such land for sowing much better than scarifiers and harrow On solid land, the machine can produce a loose tilth of from 2 to 11 or ins. deep, according to the speed at which it moves. This type, at a rate, is not designed for deeper work, but it can carry it out as a tractor towing a digging brabant.



Fig. 3. — The "Motoculteur" working as a tractor.

In normal soil of 110 to 132 lbs resistance, with a width of 1300 to 16 feet, the machine is guaranteed to yield per hour of actual work (comple work and with a single turn of the rotary apparatus) as follows :

1) at least 1 800 sq. yds at 9 to 12 ins. deep (1st. speed forward)
2) » » 3 000 » » » 7 to 10 » » (2nd. speed forward)

3) at least 4 800 sq. yds. at 5 to 7 ins. deep (3rd. speed forward)
4) » » 7 200 » » » 2 to 3 » » (4th. speed forward) for hoeing, ploughing-up stubble.

In practice, deducting stoppages and the usual losses of time, the chine will perform: about 3.25 acres of hard digging-work, either loosened rabant-style; about 6.25 acres of average work, tillage or ordinary plough- with a 3-furrow plough; about 15 acres of hoeing or ploughing-up of bble.

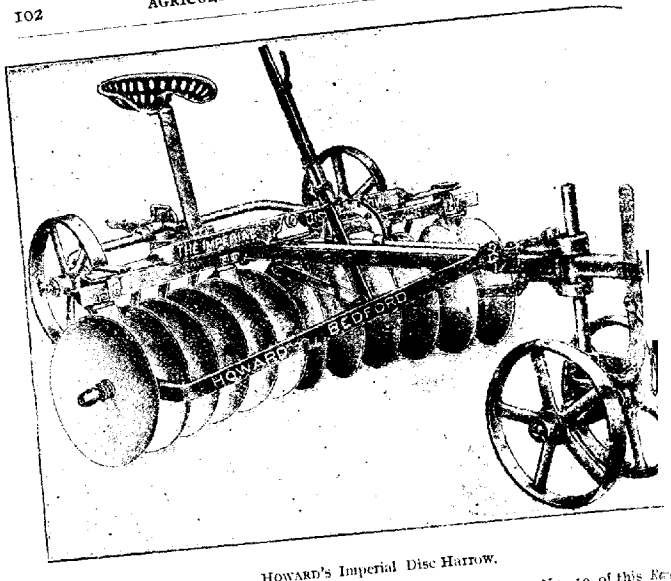
The working tools each consist of a claw and a spring, fixed together the rotating axle, without screws or bolts; they are interchangeable l easily replaced if broken. The wear of the claws depends on the kind of ; in rocky soils or for certain work it is advisable to use the machine as lough-tractor.

The " Motoculteur " is provided with special seeders, and it ploughs, rows down, sows and rolls all in one turn (cereals, maize, beets, etc.). an be used for planting potatoes, the fertiliser being sown simultaneous- When standing at the farm, its engine drives the fixed farm machinery. ingle workman is always sufficient to drive the " Motoculteur ", no tter what the work is.

According to M. FRÉMIER, the work done by the " Motoculteur " ms to be all that could be desired from the point of view of modern icultural science. In a single turn, it will obtain that uniform struc- e in the whole layer of earth worked that is necessary for a perfect *seed* . According to the crop, and according to the soil, be it dry, wet, or n pebbly, the size of the clods and the fineness of tilth required are ly regulated. When the soil is covered with a normal layer of farmyard nure, the machine mixes it intimately with the soil throughout the culti- ed layer, thus favouring nitrification. Only a small part of the long- straws and residue remains visible on the surface. As for other fer- ers and dressings, the motoculteur mixes them evenly throughout the ivated layer. If the machine is used on land covered with vegetation erne, mustard, vetches, lupins, etc.) or stubble, it tears the plants to es and buries the fragments. However, for such work which is heavy the engine, sharper claws placed closer together should be used.

- **Howard's " Imperial " Disc Harrow.** — *The Implement and Machinery Review*, Vol. 43, No. 511, p. 722, 1 fig. London, November 1, 1917.

The " Imperial " steel disc harrow, illustrated below, is constructed Messrs. J. & F. HOWARD, of Bedford, England. The transport wheels the rear of the implement can be easily raised during working, and, con- rsely, the harrow raised for travelling. By a lever, the discs can be justed to suit the peculiarities of the ground. The fore-carriage pos- sses a rocking movement from which great advantage is derived on rough d rocky land. This disc harrow is suitable for attaching behind a plough wed by a tractor. It is made in four widths, with 12, 14, 16 and 20 discs either 18 in. or 20 in. diameter.

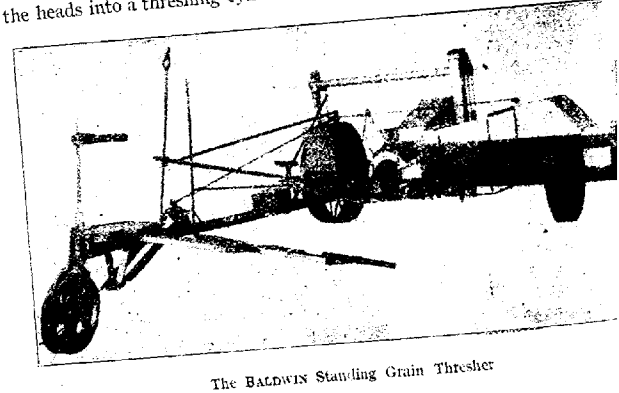


HOWARD'S Imperial Disc HARROW.

86 – **Mower for Gathering Kelp, in the United States.** — See No. 19 of this *Rev*

87 – **The Baldwin Standing Grain Thresher.** — *Farm Implement News*, Vol. XXXV No. 79, p. 25, 1 fig. Chicago, September 27, 1917.

This machine, reproduced below, does not head the grain, but dra the heads into a threshing cylinder which shakes out the kernels and lea



The BALDWIN Standing Grain Thresher

ıe straw standing uncut. It handles a 12-foot swathe. The machine drawn by horses or a tractor, but the operating mechanism is driven by WANKESHA motor. All the gears are enclosed and HYATT roller bearings e used extensively.

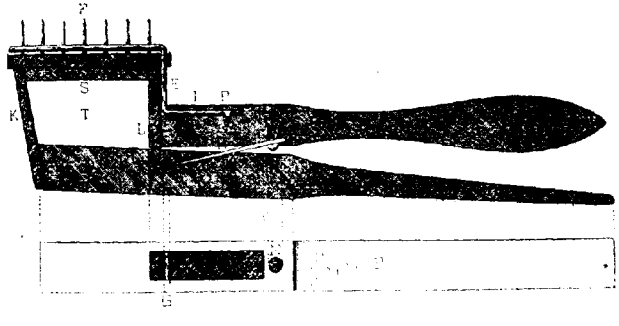
The grain is delivered into sacks by the machine. One or two men suf- e for attention. In regions where there is little fear of lodging and where l the grain ripens at the same time, the machine should save a deal of ınd-labour.

A number of the machines are already in use in western Nebraska, ınsas and Texas.

– **The Rebuffel "Olive Gleaner".** — REBUFFEL, A., in *Republique Française, Office National de la Propriété Industrielle, Brevet d'Invention* No. 484560, 1 p. + 6 figs Published at Paris on October 18, 1917.

A new apparatus, called the "Olive Gleaner", for rapidly collecting len olives.

The appended figure shows the longitudinal section of the apparatus, well as the upper surface of the handle. The device consists of a small ard D bearing a number of points F, through which a lattice ejector E



REBUFFEL'S "Olive Gleaner".

vorks on pressing the lever C to the handle B. By means of the spring R, he ejector-lever takes up its former position on releasing the pressure. The spring R, whose pivot G is fixed to the handle B, is attached to the ever by a screw Q; the action of the spring is helped by the mortise M. The heads of the points F of the piece D are held in position by a plate S, laced under the upper board D; these two boards are fixed to the handle B y both back and front sides K and U respectively, leaving a hollow, T, be- ween them. The ejector E is fixed on the lever by a screw P passing hrough its end and held by a wedge piece.

To use the apparatus, it is taken in the hand, the points turned to wards the soil. The olives are collected by striking them from above dow wards, when they are pierced by the points. When the points are full olives, the apparatus is held over a basket, and on pressing the lever, th ejector moves up and removes the olives, which fall into the basket. there are great numbers of fallen olives, the workman may use a seco apparatus for the left hand.

89 – **The "Alpha" Apparatus for the Discovery of Metallic Objects in the Soil.**
Le Génie Civil, Vol. LXXI; No. 19, pp. 312-313, fig. 2. Paris, November 10, 191

From the data of M. GUTTON, who devised a machine for tracing projectiles buried in the soil, M. CHANOIT, Engineer, of Villeneuve-Sain Georges, has constructed a new "Alpha" apparatus (so called because o its A-shape), by means of which a 75 shell buried 16 to 20 ins. in the so may be located.

By means of the apparatus, any metallic object weighing 22 lbs an buried up to 20 ins. deep in the soil may be located.

The apparatus, based on the principle of the HUGHES induction balanc consists of 4 exploring coils wound two by two round two horizontal plat or circles of wood of 24 in. diameter and suspended at the ends of t wooden arms inclined at 45° towards the soil, and held firm by a cross mem ber. The parts are all jointed. The centres of the plates are about ins. apart, so that the apparatus controls a distance of about 82 ins. T regulating device is placed on the angle formed by the two inclined arm it includes two enclosed coils, connected to the two rolls of wire fixed on th plates. Ordinary telephone receivers, carried by a telephonist's cap, ar used as detectors.

A pile of 2 or 3 elements and a Ruhmkorff coil with a trembler provid the current. Both induction coil and pile are contained in a portable box and joined to the exploring apparatus by long wires. Such as it is at pre sent, the apparatus indicates the presence of a metallic mass buried abou 20 ins. in the soil by means of the resonance of the telephone. As yet, suc objects can only be discovered at a slight depth, but experiments are bein carried out to increase its efficiency.

The instrument is light and easily handled, being entirely constructe in wood. It can be partly unmounted and folded to assist its transport.

90 – **Review of Patents.**

Village Machines and Implements.

Canada	177 938.	Harrow.
France	484 471.	Device adjusting automatically the beam in the fore-carriage a double brabant plough.
Netherlands	2 205.	Sugar cane stalks covering plough.
Switzerland	72 283.	Tractor plough.
United-Kingdom	109 340.	Cultivator.
	109 446.	Cultivating implement (motorplough).
	109 618.	Plough (for mechanical traction).

ited States 1 239 559 — 1 240 047 Tractor ploughs.
1 239 627. Harrow tooth.
1 240 087 — 1 241 530. Gang ploughs.
1 240 542. Rotary harrow.
1 241 033 — 1 241 064 — 1 243 203 — 1 244 165. Harrows.
1 241 046. Rotary wheel-harrow.
1 241 094. Method for renewing wornout plough points.
1 241 173. Tilling machine.
1 241 382. Cultivator.
1 241 774. Flexible disc harrow.
1 241 775. Flexible frame harrow-cultivator.
1 242 128. Cleaning attachment for harrows.
1 243 072 — 1 243 833 — 1 244 274. Ploughs.
1 243 758. Subsoil and grubbing plough.
1 244 016. Harrow and truck.
1 244 295. Seat attachment for riding harrows.

Irrigation.

ited States 1,239 692. Water elevator.

Manures and Manures Distributors.

ited-Kingdom 109 575. Manure distributor.
109 671. Fertilisers (Process for manufacture of organic fertilisers).
ited States 1 242 705. Manure spreader.

Drills and Seeding Machines.

nada 178 013. Grain box for drills.
178 014. Foot cup for drills.
ited States 1 239 599. Device and method of preparing seed beds.
1 240 227. Seed planter.
1 240 529. Potato planter.
1 242 061. Fertilizer-distributor and planter.
1 243 541. Maize planter.
1 243 560. Grain drill.

Various Cultural Operations.

nada 177 904. Weeder.
ited States 1 239 945 — 1 243 970. Cultivators.
1 240 088. Combined ridger and blocker.
1 243 046. Cotton chopper or blocker.

Control of Diseases and Pests of Plants.

nada 177 928. Animal trap.
178 041. Insecticide.
nce 484 796. Chemical preparation for the rational treatment of fungous diseases of plants.
ited-Kingdom 109 060. Animal trap.
ited States 1 239 501. Insect killer.
1 239 684. Boll-weevil destroyer.
1 240 736. Device for catching boll-weevils.
1 244 069. Animal trap.

Reapers, Mowers and Other Harvesting Machines.

nada 178 015. Harvesting machinery.

France 484 560. Olive gleaner (1).
Switzerland 76 395. Motor mowing machine.
United-Kingdom 109 027 — 109 635. Reaping and mowing machines.
109 094. Swath turner.
109 116. Lawn mower.
109 250. Flax pulling machine.
United States 1 239 570. Cutting apparatus for mowers.
1 239 614. Cotton harvesting and cleaning machine.
1 239 621. Adjusting mechanism for shocking machine.
1 239 685. Row-binder.
1 239 686. Lawn rake.
1 239 763. Hay rake attachment.
1 239 767 — 1 242 761. Cotton harvesters.
1 239 791. Grain binder deck.
1 240 028 — 1 241 490. Grain harvesters and binders.
1 240 128. Fruit picker.
1 240 164. Maize harvester and ensilage cutter.
1 240 361. Mowing machine.
1 240 424. Wind shield for harvesters.
1 240 847. Maize harvester.
1 241 096. Side delivery rake.
1 241 198. Harvester for cabbage and similar plants.
1 241 325. Ensilage harvesting machine.
1 241 452. Header attachment for tractors.
1 242 112. Shocking machine.
1 242 240. Binder locking mechanism.
1 244 074. Swath divider for harvester.
1 244 152. Combined harvester and thresher.
1 244 341. Basket for lawn mowers.

Machines for Lifting Root Crops.

United States 1 239 921. Potato digger.
1 239 935. Peanut and potato harvester.
1 240 955. Beet harvester.
1 241 108. Root harvesting machine.
1 241 761. Beet topping machine.
1 243 898. Potato-digging attachment for ploughs.

Threshing and Winnowing Machines.

United States 1 239 922. Potato separator.
1 240 999. Bean separator.
1 241 028. Threshing machine.
1 241 045 — 1 243 284 — 1 243 528. Grain separators.
1 241 980. Recleaner structure for the threshing machine.

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

Switzerland 72 284. Device for regulating the fermentation in stacked fodder particularly in hay-stacks.
United States 1 239 871 — 1 241 548 — 1 241 981 — 1 243 035. Hay presses.
1 240 935. Elevator for silos.
1 242 812. Hay stacker.

(1) See description and illustrations of No. 88 of this *Review*. (*Ed.*)

1 243 570. Automatic binder attachment for hay presses.
1 243 754. Tamping device for silos.

Traction and Steering of Agricultural Machinery.

nited-Kingdom 109 960. Motor tractor.
nited States 1 239 603. Cushion spring for 3 wheeled tractors.
1 240 338 — 1 240 488 — 1 240 650 — 1 240 761 — 1 240 782 — 1 241 034 — 1 241 617 — 1 241 766 — 1 242 555 — 1 243 184 — 1 243 598. Tractors.
1 240 758. Plough draw-bar head and leveler for tractors.
1 241 446. Variable speed gearing for the reels of agricultural machinery.
1 243 019. Tractor implement controlling mechanism.
1 243 414. Tractor attachment for automobiles.
1 243 704. Plough hitch mecanism.

Housing of Livestock.

nited-Kingdom 109 865. Horse shoe.
nited States 1 240 437. Hog feeder.
1 241 495 — 1 243 127. Hog oilers.
1 243 689. Feed-trough.

Poultry Farming.

witzerland 76 398. Incubator.
nited States 1 239 637. Brooder.
1 243 797. Regulator for incubators.

Bee Keeping.

nited States 1 239 536. Bee shipping package.

Industries Depending on Plant Products.

nada 177 934. Flour mixer.
178 505. Paste production.
etherlands 2 176. Process for manufacturing a dried food product from wastes of potato-flour mills.
2 185. Apparatus for extracting potato-flour from a concentrated juice.
nited Kingdom 109 693. Drying tea.
nited States 1 239 555. Process of treating rice and products thereof.
1 244 038. Fruit slicing machine.
1 244 210. Flour mill machinery.
1 244 420. Drying room for cereal pastes.

Dairying.

witzerland 76 322. Device for cleaning cream separator bowls.
76 323. Churn.
76 481. Butter making apparatus.
nited Kingdom 109 471. Apparatus for drying milk, etc.
109 589. Centrifugal separator.
109 638. Milk sterilizing apparatus.
nited States 1 239 471. Milk powdering machine.
1 239 923. Milking machine teat-cup.
1 240 765. Milking machine.
1 243 788. Cheese shelf.

Farm Buildings and Equipment.

Canada 178 381. Wire stretcher and splicer.
United States 1 240 135 — 1 244 220. Silos.
1 243 829. Silo-door.

Various.

United-Kingdom 109 907. Rotary pump.
109 961. Centrifugal pump.
United States 1 241 305. Horse collar.

RURAL ECONOMICS.

91 – **The Milk Producer's Problem in the United States.** — GILLETTE, L. S. (Iowa State College), in *Hoard's Dairyman*, Vol. LIV, No. 11, pp. 324. Fort Atkinson, Wis., October 5, 1917.

There is no industry which is suffering as severely in the present crisis as that of milk production, while one-fifth of the total food supply of the United States is the dairyman's task.

The accompanying table shows the average price which the dairy farm operated by the Iowa State College was compelled to pay for feeds during the years July 1, 1914, to June 30, 1915, and July 1, 1916, to June 30, 1917, as well as the market quotations of the same feeds August 1, 1917. It shows that in the two year interval the price of feeding stuffs has increased from 70 to 205 %, as in the case of corn. Alfalfa hay is not quoted, but it will reach the highest price this winter to which it has ever soared. The problem of the dairyman, therefore, seems to be the utilization of feeding stuffs that have increased 100 to 200 % in cost for production of dairy products that are selling for only 25 % more than formerly.

Dairy farming has never been noted for large returns; its popularity is based upon the certainty of the income, usually at a small profit. Now the great increases in the cost of production brought about largely by the rise in cost of labour, increased value of cows and price of feeding stuffs transform the profit to a loss. The relief must be sought principally in:

1) Higher prices for product.
2) Elimination of the boarder cow.
3) Economical selection of concentrates.

Of these factors the first one is of primary importance and will be achieved through education of the consumer and organization of the producer. The second factor determines the degree of profit of the dairyman regardless of the price received for the product. A too large percentage of boarder cows will make any dairy a financial liability. The last factor is one which varies rather widely with the locality, season and year. While roughages are much more expensive than formerly they are still the cheapest source of food nutrients. In those herds which are kept for commercial milk production the more limited use of concentrates is the practical policy to pursue. Silage is a cheaper source of energy for all kinds of dairy stock than alfalfa and no dairyman with even a small herd can afford to be without it because of its succulence, palatability and economy.

Prices of feeding stuffs per cwt.

Feed	July 1, 1914 June 30, 1914	July 1, 1916 June 30, 1917	August 1, 1917	% increase
Corn meal	$ 1.525	$ 2.25	$ 4.65	205
Bran	1.1375	1.73	2.65	132
Cottonseed meal	1.50	2.10	3.00	100
Oil meal	1.48	2.28	3.25	119
Ground oats	1.156	2.24	2.60	124
Gluten feed	1.35	1.86	3.15	133
Unicorn	1.60	—	2.75	71
Alfalfa hay	0.80	1.20	—	185
Corn silage	0.175	0.30	0.50	—
Dried beet pulp	1.25	—	—	—

– **Economic Relations between the Tractor and the Farm.** — See No. 80 of this *Review*.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANTS PRODUCTS

– **Methods for Determining the Adulteration of Wines.** — PRATOLONGO, UGO, in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. L, Pt. 6-7-8, pp. 315-364. Modena, 1917.

The chief methods for determining the adulteration of wine are examined separately.

The essential condition which any such method must fulfill is that it must be possible to distinguish clearly between natural and adulterated wines so that the dividing line includes *all* the natural wines and *these wines* only. Up to the present no method has been found fulfilling this double condition; each of them, while answering to one of the conditions, sacrifices the other more or less.

In order to determine the true value of the various methods the author examined 560 natural Italian wines, using analytical data supplied by the publications of the Italian Ministry of Agriculture.

The author gives a table on which are 2 curves interpreting the various methods examined, the alcohol content of the wines being represented by the abscissae and their acidity expressed as grammes of tartaric acid per litre, by the ordinates.

GAUTHIER'S *method*. — The total *alcohol* + *sulphuric acidity* must exceed a minimum value, fixed by Gauthier at 13, and reduced by the French Committee of Arts and Manufactures, to 12.5, and fixed at 12.5 and 11.5 for table wine and Aramon wine respectively by the French official methods. Expressing the alcohol content of the wine by g, its acidity, expressed as grammes of sulphuric acid per litre, by a_s, and the constant whose value is equal to 12.5 by C, the following formula is obtained: $g + a_s > C$.

This method includes *all* natural wines (of 560 natural wines only one appeared adulterated), but does not include *only* these wines (20 % of method).

HALPHEN'S *method*. — This is expressed by the formula

$$\frac{a_s}{g} > 1.160 - 0.07\,g$$

(the letters having the same signification as above).

Placing this formula in the form $a_s > 1.160\,g - 0.07\,g$, the maximum acidity would be obtained with $g = 8.28$. As this has in no way been proved the author considers the rule to have no rational basis.

Contrary to that of GAUTHIER this rule fulfills the just condition (the inclusion of *all* the natural wines) very imperfectly, but better satisfies the second (the inclusion of these wines *only*). In the experiments made $^1/_5$th. to $^1/_6$th. of the natural wines wrongly appeared adulterated.

The author tried whether the modification introduced by POSSETTO and ISSOGLIO, and later by GALEAZZI (i. e. the introduction into the calculation of the ratio acidity : alcohol of the limit 0.120) really improved the results obtained. The diagram appended to the paper shows that HALPHEN'S rule thus modified answers the first condition, but no longer answers the second satisfactorily.

BLAREZ' *method*. — BLAREZ has given in table form the minimum acidity corresponding to each degree of alcohol by dividing natural wines into 5 categories and giving to each a dividing line between natural vines and adulterated wines.

The author's diagram shows BLAREZ' method to answer the double condition much better than the others, because it excluded the smallest quantity of natural wines and reduces to a minimum the possibility of not discovering adulteration.

ROOS' *method*. — This may be expressed as follows: — the total *alcohol* + *acidity* is in inverse proportion to the ratio *extract* : *alcohol*. According to ROOS, this coefficient is always below 25.6 in natural wines but never below 24 in adulterated wines.

This rule has about the same value as that of GAUTHIER.

CONCLUSIONS. — BLAREZ' method is the most satisfactory, although applied without modification to Italian wines it would allow too much adulteration. It must be placed within closer limits.

Taking his diagram as a basis, the author divides natural wines into 2 categories according to their composition. The first includes the greater number of natural wines, which the author arbitrarily calls " wines of normal composition ". The second includes nearly all the natural wines not contained in the first (58 out of 560 in the author's experiments, *i. e.*, about $^1/_{10}$) and called " wines of abnormal composition ". The figures fixing the limits of the 2 categories of natural wines are given in 2 tables.

In order to apply these methods, all Italian wines of non-declared origin may be placed in the 1st. category. The wines of the second category could only be used commercially with a declaration of origin which would justify their abnormal composition. Wines of a composition below the limits fixed by the second category should be considered adulterated unless proof to the contrary can be furnished.

1st. category Wines of normal composition		2nd. category Wines of abnormal composition	
Alcohol content	Tartaric acid minimum	Alcohol content	Tartaric acid minimum
8	15.30	6	12.70
8.5	10.30	6.5	10.30
9	8.40	7	8.80
9.5	7.10	7.5	7.50
10	6.00	8	6.40
10.5	5.30	8.5	5.70
11	4.90	9	5.10
11.5	4.60	9.5	4.50
12	4.40	10	4.10
12.5	4.20	10.5	3.80
13	4.10	11	3.60
13.5	4.00	11.5	3.50
14	3.90	12	3.50
14.5	3.90	12.5	3.50
15	3.90	13	3.50
		13.5	—
		14	—
		14.5	—

– **The Use of Horse-Chestnuts for the Production of Alcohol** (1). — KAYSER, in *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 45, p. 10. Paris, November 6, 1917.

The author (Director of the Fermentation Laboratory of the National ricultural Institute) gives the following figures for the content of the rse-chestnut in carbohydrates and nitrogen, comparing them with those maize and rye.

Description	Composition per cent		
	Moisture	Nitrogen	Carbohydrates
resh uncorticated horse-chestnuts	49.2	4.8	40.9
ried » » » »	18.8	6.9	53.7
resh decorticated » »	51.0	3.9	39.2
ry » » » »	10.5	7.2	71.8
verage maize.	13.0	9.9	69.2
verage rye.	13.4	11.5	69.5

The horse-chestnut has an average content of 0.5 % of potassium and 0.15 % of phosphoric acid, foods necessary to alcoholic fermentation.

Experiments carried out by the author show that the yield of 27 to 28

(1) On the use of horse-chestnuts, see: — *R.* October, 1917, No. 954; *R.* December, 917, No. 1185. (*Ed.*)

litres of alcohol per 100 kg. of dry horse-chestnuts, although inferior to that of maize, is sufficiently high, in view of the moderate cost of the chestnuts (12*s.* 8*d.* per 100 kg. of dry nuts), to justify their use for making alcohol in war time.

95 – **Utilisation of Acorns by Acoholic Fermentation.** (1). — KAYSER, in *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 49, pp. 9-10. Paris, December 1917.

The author (Director of the Fermentation Laboratory) describes the results obtained by the alcoholic fermentation of sweet acorn juice.

The experiments were carried out with three varieties of oak, pedunculate, sessile and holm, found in the Mediterranean district. Whole acorns and kernels were used. The sweet liquid was obtained by treating the acorns (without the cups), cut into small pieces with twice, and sometimes four times, their weight of water in the presence of 2.5 % of hydrochloric acid or 1 % of sulphuric acid during half an hour in the autoclave at 120-122°C. The sweet liquid is filtered off, the solid residue being crushed in a mortar and treated with hot water till the liquid is completely extracted. The liquids are neutralised with potash up to an acidity of 1 % in sulphuric acid.

Either grain or cider yeast was added to the sterilised liquids. Fermentation usually started after 24 hours, rather more rapidly in flasks to which had been added from 1 to 2 ‰ of sweet rye extract (nitrogenous and phosphatic food), more rapidly also in those of greater dilution, which is comprehensible, for an excess of tannin, of which acorns contain a fairly large proportion, prevents alcoholic fermentation.

Grain yeast gives a yield slightly higher than that obtained with cider yeast.

The yield from whole acorns varies form 8.58 to 20.16 litres of alcohol per 100 kg. of dry material, whereas for the kernels, it may amount to as much as 28, 29 or 31 litres. This yield is higher than that obtained by the author for horse-chestnuts, although, in a certain sense, these fermented more easily (2). The yield varies with the degree of ripeness, the variety and, above all, the dilution (influence of the tannin).

It is best to use dry acorns, freed from their cups by threshing and sifting.

96 – **Unsalted Lime Bread.** — See No. 3 of this *Review*.

97 – **The Problem of Sugar Manufacturing in India.** — WYNNE, SAYER, in *The Agricultural Journal of India*, Vol. XII, Part. IV, pp. 550-565. Calcutta, October, 1917.

After a thorough examination of the problem of the Indian Sugar Industry in its different aspects, the writer, summing up his various points of view, makes the following statement: The problem of the Indian Sugar Industry is a two-fold one, and energetic measures should now be set

(1) On the use of acorns as a food for cattle see No. 66 of this *Review*. — (2) See No. 94 of this *Review*. (*Ed.*)

ı foot to place both the *gur* and the white sugar industries on a satis-ctory working basis. To do this properly will require a survey to be ade of the localities where white sugar factories can be erected, and a e same time the districts where the cane cultivation is only capable carrying a *gur* factory should be carefully recorded. The financial side the matter and the question of State assistance to the pioneer factories so require to be carefully examined.

To do this will require a strong committee of experts who will also be ıle to report to Government how far the manufacture of sugar on a consider-ıle scale together with its by-product — alcohol — can be made the bject of excise control in India. The question of the creation of a special gar department for India for tackling and coordinating the numerous anufacturing, agricultural, botanical and chemical problems connected th the industry could also be dealt with, but the main question is to get dealt with at once, for, at present, Indian sugar is being made under ost favourable conditions and this state of things, which gives an insight to the possibilities of the industry in India, when foreign competition lacking or curtailed, will not last for long, and if the industry, which is w in places getting its head above water, is allowed to be stifled again unfair competition, it will not readily respond to efforts made in the ture to resuscitate it.

– **The Manufacture of Sugar in the Republic of Salvador.** — See No. 46 of this *Review*.

– **The Utilisation of Grape Residue as Fuel.** — MATIGNON, C. and MARCHAL, G., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 21, pp. 718-721. Paris, November 19, 1917.

A thermal study of grape residue showed it to have about the same lue as peat as a fuel. Its thermal constants, chemical composition and h content, are exactly similar to those of peat. There is no doubt that might be used, like peat, in suitable stoves. Experiments on this subject ll shortly be carried out with the residues from the last harvest.

In a normal average year, with a French production of 50 million ectolitres of wine, it would be possible to obtain, after distillation, sidues having a calorific value equivalent to more than 160 000 metric ns of coal.

po – **Celery Storage Experiments.** — THOMPSON, H. C., in *United States Department of Agriculture, Bull.* No. 570, pp. 26, 16 figs., 17 tables. Washington, September 5, 1917. AGRICULTURAL PRODUCTS; PRESERVING, ETC.

Celery growing is of great importance in the United States. The farm alue of the crop in 1909 was $ 3 922 848, but, as a considerable portion of is is stored for one to three months, its commercial value is much superior) the farm value given.

This value may be increased by good storage methods. The old methods re gradually being given up more and more in favour of cold-storage. n spite of this, celery is so difficult to store that many warehouses prefer to evote themselves to other products.

Very few data on the cold storage of celery are available. The expe-

riments carried out by the United States Department of Agriculture during period of four years, 1912-1910, aimed at determining :

1) The factors which hasten decay in celery in storage houses.

2) The best methods of reducing the loss of celery in storage due to decay and mechanical injury.

3) The best type of crate in which to pack celery to be cold-stored.

4) The effect of the temperature of the storage room on the keeping quality of celery.

The experiments were carried out in three cold-storage warehouses Elmira, Hornel and Williamson, N. Y.

Large crates are favourable to decay, which begins in the centre. Injury to the celery is chiefly due to the breaking of the crates.

The celery suffered less injury when packed in smaller crates and in those with a longitudinal or transversal ventilation partition down the centre. The 14 inch crate gave the best results, followed by the 16 inch crate and the 11 inch crate. The standard crate varies in size from 22 by 24 by 24 inches. Small crates, though slightly more expensive than large ones, are preferred by many cold-storage warehouses because it is easier to handle them and the proportion of broken crates is smaller.

A market test showed that celery stored in small crates sells for a much higher price than that in standard crates handled in exactly the same way.

The crates were piled up in five tiers. The celery in the top tier was decayed in a larger proportion than that in the lower tiers.

There was a greater difference in the keeping quality of the celery in the different tiers in standard crates than in the other crates.

The difference in the keeping quality of the celery in the different tiers is probably due to the difference in temperature of the room at different heights. The temperature of the air at the fifth tier averaged 2.4° F. more than that of the first tier. The temperature of the celery in standard crates averaged 2.7°F. higher at the fifth tier. The temperature of the celery in the standard crate averaged 2° F. higher than in the partition crate and 4.1° higher than the air at the same height.

In order to check properly the temperature of the room, thermometers should be placed at different heights. In many cases when the temperature at 4 feet from the floor was 32° F., that near the ceiling was found to be from 35 to 36°.

101 – **The Cost of Cattle Foods in the United States, from 1914 to 1917.** — See No. 91 of this *Review*.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

02 - **New Japanese Fungi** (1). — TANAKA, TYOZABURO, in *Mycologia*, Vol. IX, No. 6, pp. 361-368. Lancaster, Pa., November, 1917. GENERAL

This third note gives an English translation of the systematic descriptions, originally published by the authors in Japanese, of the following new species of fungi.

1) *Massaria moricola* I. Miyake n. sp. (published in December, 1916), common on twigs of *Morus alba* in the following localities: — Gifu-ken (prefecture), Kaidzu-gun Kaisaimura (1909); Fukui-ken (pref.); Ôno-gun and Hida-no-kuni (Gifu prefecture), Mashita-gun, Shimohara-mura (1909); Nagano-ken (pref.), Shino-ina-gun (1910); Tokyo-fu (pref.), Nakano-chô (1915); Tochigi-ken (pref.), Utsunomiya-shi and Fukushima-ken (pref.), Fukushima-shi (1915); Kyoto-fu (pref.); Ayabe-chô (1915).

2) *M. japonica* I. Miyake n. sp. (December, 1916); not common, on twigs of *Morus alba* in the following localities: — Gifu-ken (pref.), Ena-gun Kashimo-mura (1909); Iwate-ken (pref.); Hanamaki-chô (1915).

3) *Mycosphaerella Horii* K. Hara n. sp. (March, 1917) on leaves of *Citrus*; type localities: — Hamana-mura, Inasa-gun, Shidzuoka-ken (1914), Katarô, Shimidzu; Japanese name of disease: Kashaku "Ko-maruboshibyô"; Dr. SHÔTARÔ HORI considers the cause of this disease to be *Phyllosticta citricola* Hori n. sp.; as no description of the fungus is given it is impossible to determine whether it is a form of *Myc. Horii*, but the existence of such a relationship is very probable; according to HORI the fungus mostly attacks the navel variety of *C. sinensis* and *C. nobilis* var. *unshiu* (Unshu [Satsuma] orange);

4) *Phyllosticta citricola* Hori, n. sp. (published in July, 1913, without description, and published again in March, 1917); on leaves of *Citrus*; type localities: — Toyoda-mura, Abe-gun, Shiyzuoka-ken (1914); Japanese name of disease: — "Kasshoku Ô-maruboshibyô"; the same disease is reported to have caused great injury to the Japanese summer orange ("Natsudaidai") in the province of Toyoda-gun (Hiroshima-ken), and also in Abe-gun, Shidzuoka-ken; HORI reported it as also attacking *C. nobilis* var. *unshiu*.

(1) See also *R.* Oct., 1917, No. 965. (*Ed.*)

103 – **New or Noteworthy North American Fungi.** -- DEARNESS, J., in *Mycologia*, Vol. IX No. 6, pp. 345-364. Lancaster, Pa., November, 1917.

The list includes 51 species of fungi either new or worthy of note, collected at different times in various districts of North America. A systematic description is given of the numerous species new to science.

Special mention should be made of the following: —

1) *Asterina* (*Asterella*) *fumagina* Dearn. and Barth., n. sp., on living leaves of *Panicum latifolium*, Maricoa, Porto Rico ;

2) *Phacidium Gaultheriae* Dearn., n. sp., on living stems of *Gaultheria Shallon*, Vancouver Island ;

3) *Exoascus Aceris* Dearn. and Barth. n. sp., on living leaves of *Acer grandidentatum*, Parley's Canyon, Utah ;

4) *Cicinnobolus major* Daern. and Barth., n. sp., on *Oidium* on living leaves of *Grindelia squarrosa*, Billings, Mont. ;

5) *Septoria samarae-macrophylli* Dearn. and Barth., n. sp., on green samarae of *Acer macrophyllum*, Duckabush River, Wash. ;

6) *Sept. Sarcobati* Dearn. and Barth., n. sp., on the calyx of *Sarcobatus vermiculatus*, Tromberg, Month. ;

7) *Melasmia Menziesiae* Dearn. and Barth., n. sp., on living leaves of *Menzieisa ferruginea*, Duckabush, Wash. ;

8) *Gloeosporium Ailanthi* Dearn. and Barth., n. sp., on living leaves of *Ailanthus glandulosa*, Shreveport, La.;

9) *Gl. Bartholomaei* Dearn., n. sp., on living leaves of *Ribes bracteosum*, Port Orchard, Wash. ;

10) *Gl. Betae* Dearn. and Barth., n. sp., very injurious to sugar-beet leaves, Billings, Mont. ;

11) *Gl. Crataegi* Dearn, and Barth., n. sp., on living leaves of *Crataegus brevispina*, Vancouver, Wash. ;

12) *Marssonina bracteosa* Dearn. and Barth., n. sp., on living leaves of *Ribes bracteosum* attacked by *Gl. Bartholomaei*, Port Orchard, Wash.

13) *Septogloeum Nuttallii* Hark., on living leaves of *Osmaronia cerasiformis*, Vancouver Island ;

14) *Sept. Schizonoti* Dearn., n. sp., on living leaves of *Schizonotia discolor*, Vancouver Island ;

15) *Sept. Salicis-Fendlerianae* Dearn. and Barth., n. sp., on living leaves of *Salix Fendleriana*, Caldwell, Idaho ;

16) *Cylindrosporium Artemisiae* Dearn. and Barth., n. sp., on living leaves of *Artemisia Suksdorfii*, Pleasant Beach, Wash. ;

17) *Fusoma rubricosa* Dearn. and Barth., n. sp., on living leaves of *Calamagrostis scabra*, Glacier National Park, Mont. ;

18) *Ramularia Clematidis* Dearn. and Barth., n. sp., on living leaves of *Clematis ligusticifolia*, Billings, Mont. ;

19) ? *Cercosporella Aceris* Dearn. and Barth., n. sp., injurious to living leaves of *Acer macrophyllum*, Duckabush, Wash. ;

20) ? *C. Alni* Dearn. and Barth., n. sp., injurious to leaves of *Alnus rubra*, Bremerton, Wash. ;

21) *Cercospora Streptopi* Dearn. and Bart., n. sp., on living leaves of *Streptopus amplexifolius*, Duckabush River, Wash.

4 - **Rust Resistant Manitoba Wheat, in France.** — See No. 34 of this *Review*.

5 – **Vines Offering a Relative Resistance to Mildew.** — SALOMON, RENÉ, in *Revue de Viticulture*, Year 24, Vol. XLVII, No. 1220, pp. 311-316. Paris, November 15, 1917.

A list of French vines is given which, in any kind of year, give a full rvest, and which, even in 1917, were perfectly immune to mildew of the iit with four sprayings only.

I. WHITE GRAPES. — "Meslier Saint-François" or "Meslier du Gâ-iais"; "Meslier hâtif", too well known to require description.

"Meslier rose", less productive than "Saint-François", yielding as ich as 1 780 gallons per acre of a colourless wine which keeps excellently, t more productive than "Meslier hâtif" with an equivalent choice table ne.

These three varieties are easily protected however violent the attack ıy be. They are closely followed by:

"Aubin blanc" (Lorraine), late 1st. period. Strong and of regular eld (short pruning). At Fuvezin (Meurthe-et-Moselle) this plant has ven extraordinary harvests.

"Bouquetriesling", "Feinriesling", "Firnriesling", "Goldriesling" t period. Obtained from OBERLIN (Alsace). Strong and fertile. First ltivated in Auvergne experimentally, are now gradually grown over an reasingly large area, especially "Goldriesling" (medium pruning)

Next come the following, which are also easily protected:

"Ezer Jo", early 2nd. period, very fertile. Enormous yield. Very e appearance (short pruning).

"Fernand rose" (OBERLIN), early 1st. period. Very heavy yield ıort pruning). Mixed vat and table wines.

"Gros Pinot blanc hâtif", 1st. period, vigorous and fertile. Selection "Pinot blanc Chardonnay". The most resistant of all "Pinots blancs" oidium (long pruning).

"Putzcheere", early 2nd. period, called, on account of its extraor-ıary fertility "Aramon du Nord", strong plant (short pruning).

"Sylvaner blanc", late 1st period. Heavy yield of a light, sweet, easant wine (short pruning).

"Tantovina", 2nd. period. Very heavy yield. Wine identical with at of "Meslier du Gâtinais (short pruning).

"Traminer rose", late 1st. period, in great demand in Alsace, where produces excellent wine (long pruning).

"Weisser Klœvner" or "Pinot blanc vrai", 1st period, Alsace, excel-ıt quality wine (long pruning).

II. RED GRAPES. — "Lasca", 1st. period, adapts itself to almost all posures; very good wine; very resistant to rot (ample pruning).

"Magyar Traube", early 1st. period, heavy yield, mixed vat and table ordon pruning).

"Patte d'oie", 1st. period, good plant, regularly fertile (short pruning).

These are closely followed by:

"Gamay teinturier supérieur", 1st. period; yield equivalent to that "Fréau", but wine less acid, and flowing differently (medium pruning).

" Gougenot ", late 1st. period, shoots open fairly late, gives a light, ver refreshing wine (medium pruning).

" Limberger ", late 1st. period gives an abundance of good table win (long pruning).

" Melascone nera ", late 2nd. period, " Pinot " to be recommende for its fertility and the superior quality of its wine (long pruning).

" Pinot noir Saint-Laurent ", late 1st. period, " Pinot " giving a yiel double that of the best selected " Pinots "; excellent quality wine, resistan to black rot (long pruning).

" Pinot Renevey amélioré ", 1st. period, selection of " Pinot noir " but with a heavier yield (long pruning).

ANS VENTION ONTROL

106 – **Patents for the Control of Diseases and Pests of Plants.** — See No. 98 of this *Review*.

ASES ARIOUS OPS

107 – **Observations on Hemp Mildew (*Peronoplasmopara cannabina*) i Italy.** — PEGLION, VITTORIO, in *Rendiconti delle sedute della Reale Accademia dei Lin* Classe di Scienze fisiche, matematiche e naturali, Vol. XXVI, Pt. 11, pp. 615- Rome, 1917.

Repeated observations on the presence and behaviour of " hemp mildew " carried out for about ten years in the province of Ferrara, confirm the fact that, except in rare cases, this parasite is practically of no importance. Nevertheless the great frequency with which it is found in the very conspicuous form of conidial fructifications, lead the author to study it anew.

He found the first spots on plants which had already put forth their third and fourth stages of leaves. These spots were fairly large and not accompanied by deformation of the leaves of the first node, and were often confined to a longitudinal portion of the leaflet, which curves over in the form of a scythe when the leaves of successive nodes are infected. If the young plants showing signs of mildew on the first leaves are carefully pulled up and put in very damp and dark surroundings, large efflorescences of conidiophores form in 24 hours, even on the upper stages of the leaves. Only after some hours does the part occupied by the conidiophores show signs of chlorosis and turn brown.

If, on the other hand, the plants are left under their normal conditions of growth, these abundant fructifications of the parasite only occur on the leaves already infected. If the plants are left 3-4 days under these environmental conditions, a microscopic examination shows the presence of oospores in the brown, mildewed tissues, which form a source of decay. Oospores form very rapidly on loose mildewed leaves kept in a damp room but in limited numbers.

Oospores form regularly in the seed leaves, even under normal environmental conditions. On all the plants showing mildew spots on the cauline leaves, a microscopic examination of the remains of the cotyledons showed the presence of oospores and of a thick efflorescence of conidiophores.

This seems to imply that infection of the young plant takes place dur

g germination. Infection experiments were carried out with conidia on t cultures of hemp immediately after germination. Three or four days er the cotyledons of a fairly large number of the young plants were vered, on both sides, with a thick brown efflorescence formed of conidio- ores of the parasite.

The presence of a papilla at the extremity of the conidia made it ap- ar probable that the fungus in question had been wrongly placed in the nus *Peronospora*; and, indeed, close observation of the germination of e conidia showed them to behave like true zoosporangia. In order to low their development young hemp plants germinating under glass were ed. Conidia were sown in the drops of water which had condensed the cotyledons, and, at the same time, conidia were sown in drops of stilled water in the usual damp rooms. In both cases, after a period of ne varying from one to two hours, the protoplasmatic contents begin to vide, the papilla at the end disappears, and well-defined zoospores, which ove rapidly within the conidial wall, slip through the narrow opening ade at the end of the conidia; each conidium usually produces three very otile zoospores wth two flagella. One or two hours after they have nerged, they become immotile, lose their flagella, become spheroid with fferentiation of a thin wall, then develop a single or branched germination be, which moves along the epidermis to the nearest stomate.

The dichotomous ramification of the conidiospores and the germination the papillate conidia by zoospores shows the parasite of hemp to resemble melon mildew", which has been moved from the genus *Plasmopara* (*Pl. cubensis*) by BERLESE, who proposes to class it, with *Pl. celtidis*, in the b-genus *Peronoplasmopara*. ROSTOWZEW, without taking BERLESE'S servations into account, created the genus *Pseudoperonospora* in order bring out the characteristics of this fungus, but, as has been observed CLINTON, the sub-genus *Peronoplasmopora* deserves precedence both account of priority of publication and its well-defined characters. The rasite of hemp therefore no longer belongs to the genus *Peronospora* d must be placed in the genus *Peronoplasmopara* (*Peronoplasmopara nubina* [Otth.] Pegl.).

8 – **The "Irish Gold" and "Broad Leaf Burley" Varieties of Tobacco Attacked by *Thielavia basicola*, in Ireland.** — See No. 10 of this *Review*.

9 – **Black Rot Disease of Tea.** — PETCH, T., in *Department of Agriculture, Ceylon, Leaflet* No. 2, pp. 3, 2 figs., Colombo, Ceylon, February, 1917.

In two districts in the low country a new disease of tea has recently ap- ared. This disease, commonly called black rot disease, appears chiefly the leaves, but it may attack all the aerial parts of the plant.

Attention is usually drawn to the affected bushes by the blackening of e young leaves; the more tender ones at the tops of the shoots turn black, ft and rotten. The chief characteristics of the disease are the persistence hanging dead leaves and the occurrence of dead leaves united in clusters two or three, or joined to the stem by a mycelium.

The fungus causing the disease — *Hypochnus* sp. of the Thelephoraceae

family — consists of very fine threads, usually invisible to the naked ey which spread along the stems and under surface of the leaves, to which the are generally confined, giving off branches which penetrate into the livi tissues of the plant and kill them. It does not appear to cause any dama on the old stems, but on the young ones it causes premature harden in the form of scaly grey-brown patches.

On the young leaves the fungus produces small blackish-brown chocolate-brown spots, which run into one another and form a patch whi gradually extends over the whole surface. The action of the fungus not so general on the old leaves, only part being attacked as a rule.

The disease passes from the stalk to the leaf by means of the le stem, but healthy leaves may be infected by contact with diseased one

The disease usually occurs in patches scattered over the field. The is reason to believe that the fungus is an inhabitant of the Ceylon jung and spreads from the jungle to the tea. On one infected estate it was fou on an isolated group of jungle shrubs, on Gurukina (*Calophyllum Burmann* and Iramusu (*Hemidesmus indicus*).

Infection experiments on tea at Peradeniya have, so far, fail completely. This does not mean that the fungus will not attack tea Peradenya or greater heights.

The *Hypochnus* may be found be still alive on prunings left in the fi at least two months after pruning.

As the fungus lives on the stems and branches, diseased plants must pruned well back, and, since it continues to live on the prunings, the must be removed and burnt. As, also, the parasite may still exist on t older stems, the pruned bushes must be well sprayed with Bordeaux mixtu

110 – **A Disease of the Hemlock Tree.** — MURRILL, W. A., in *Journal of the New Y Botanical Garden*, Vol. XVIII, No. 213, p. 208. Lancaster, Pa., September, 1

A disease of the hemlock tree (*Tsuga canadensis*) caused by *Fom poria tsugina* Murrill was discovered by Mr. PERCY WILSON at East Hebr New-Hampshire, in August, 1905.

In July, 1917, Mr. WILSON again visited the district and collected spe mens of the fungus from the trunk of the same tree, which he found de and lying on the ground.

Living hemlocks near Bristol, New Hampshire, examined by Mr. Wi SON, were also found to be attacked by the fungus, which exists in N York as well as in New Hampshire, attacking only the hemlock tr

The disease is probably important and should be studied by foreste as well as by mycologists.

WEEDS AND PARASITIC FLOWERING PLANTS

111 – **The Destruction of Weed Seeds by Carp, in Ricefields.** — See No. 78 of t *Review*.

112 – **The Eradication of Tall Larkspur *(Delphinium exaltatum)*, a Poiso ous Weed of Cattle Ranges in the U. S. National Forests.** — See No. 55 this *Review*.

13 - **The Control of "Cogon Grass" *(Impera exaltata)*, a Grass Favouring the Incubation of Locusts, in the Philippines.** — See No. 53 of this *Review*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

14 - **Scolytid Beetles Observed in Oregon (United States).** — CHAMBERLIN, W. J., in *The Canadian Entomologist*, Vol. XLIX, No. 9, pp. 321-328; No. 10, pp. 353-356. London, 1917.

The following beetles have been observed in Oregon at different times:

1) *Conophthorus ponderosae*, Hopk., collected at Corvallis;

2) *Conophthorus* sp.: 3 adults bred from cones of *Pinus contorta* collected at Corvallis;

3) *Cryphalus amabilis* n. sp., made small chambers in many branches of *Abies amabilis* near Elk Lake; the trees looked sickly and the foliage of many branches was turning red;

4) *C. subconcentralis*, Hopk., collected at Astoria;

5) *C. grandis* n. sp., abundant on *A. amabilis* near Corvallis;

6) *Crypturgus* sp., working in the dead bark near the top of a dead fir (*Abies lasiocarpa*) near Sumpter;

7) *Dendroctonus valens*, Lec., rather common throughout the pine regions of Oregon; specially abundant in *P. ponderosa* in Eastern and Central Oregon; occasionally found at the base of the larger specimens of *P. contorta*; noted at Corvallis, Hood River, Bend, Crescent, Sumpter, Sparta, Ashland and on the Kilamath Indian Reservation;

8) *D. monticolae*, Hopk., found throughout the State on *P. ponderosa*, *P. contorta*, *P. monticola* and *P. Lambertiana*; it has caused heavy losses in North-Eastern, Central and Southern Oregon;

9) *D. engelmanni*, Hopk., this species has not before been recorded from this State; the writer collected 2 dead adults from their characteristic mines under the bark of *Picea engelmanni* near Sumpter in the Blue Mountain Region of North-Eastern Oregon;

10) *D. brevicornis*, Lec., this is the most serious pest of pine in Oregon and causes the death of a very large amount of the largest and finest pine (*P. ponderosa*) timber of Eastern, Central and Southern Oregon; thousands of dollars are expended annually in combating the pest;

11) *D. pseudotsugae*, Hopk., found in all parts of the State where *Pseudotsuga taxifolia* grows; the beetles seem to prefer injured or fallen timber, but will attack living healthy trees, as is shown by a serious infestation in South Washington and near White Pine, Oregon, where several thousand trees were killed;

12) *D. obesus*, Mannh., a rather rare beetle working in the cambium of *Picea sitchensis*, at Marshfield and Astoria;

13) *D. jeffreyi*, Hopk., this species is reported by HOPKINS as occurring in South-West Oregon: the writer, however, has seen no species working in this State

14) *Dolurgus pumilus*, Mannh., on *Picea sitchensis*;

15) *Dryocoetes autographus*, Ratz., a number of specimens referred to this species were collected near Detroit from the bark of large Douglas fir (*Pseudotsuga taxifolia*) windfalls;

16) *Dryoc. pseudotsugae*, Swaine, not uncommon in the western part of the State; found at Rainier in hibernation galleries in the outer bark of *Pseudotsuga taxifolia*, and under the bark of the same conifer near Olney; also noted at Corvallis and Detroit;

17) *Eccoptogaster unispinosus*, Lec., widely distributed in the State, works in *Larix occidentalis*, *Pseudotsuga taxifolia*, and *Picea Engelmanni*; it often causes the death of saplings;

18) *Eccoptogaster* n. sp., resembles *unispinosus* in size and form; found in the twigs of a dying *Abies grandis* at Corvallis;

19) *Eccopt. subscaber*, Lec., found throughout the State working in *Abies* and especially in *A. grandis*;

20) *Gnathotrichus sulcatus*, Lec., common in dying trees, especially in the Western portion of the State. Collected from *A. grandis*, *A. nobilis*, *Pseudotsuga taxifolia* and *Tsuga heterophylla*; noted at Corvallis, Detroit, Astoria, and in the Blue Mountain region;

21) *Gn. retusus*, Lec., found on *Ts. heterophylla*, *Pinus contorta*. *P. ponderosa* and *Pseudotsuga taxifolia*; most abundant in the Coast Range and Blue Mountains;

22) *Gnathotrichus* sp., on *Alnus oregona* at Florence;

23) *Gnathotrichus* sp., on *Acer macrophyllum* at Corvallis;

24) *Hylastinus obscurus*, Mannh., a common clover root-borer found in both Eastern and Western Oregon;

25) *Hylesinus aculeatus*, Say., not abundant, but bores galleries in *Fraxinus oregona* in the Western valleys of the State; under the synonym of *Leperisinus aculeatus* Lec., a specimen has been found on an unknown host plant at Corvallis;

26) *Hyl. aspericollis*, Lec., a rather common species attacking living and dying alder trees (*Alnus oregona*); it usually selects young individuals, but the writer collected a number of adults from old trees near Breitenbush Hot Springs; noted also at Florence and Corvallis;

27) *Hyl. granulatus*, Lec., on *Abies grandis* in the Blue Mountains;

28) *Hyl. dentatus*, Lec., rare, on *Juniperus occidentalis*;

29) *Hyl. imperialis*, Lec. rare, at Corvallis;

30) *Hylurgops rugipennis*, Mannh. under the bark of a large dead white pine (*Pinus monticola*) in Santiana national Forest;

31) *Hyl. subcostulatus*, Mann., a decided secondary pest entering dying or dead *Pinus ponderosa* after other Scolytids have started their work; especially numerous in this host in the Blue Mountain region.

32) *Hyl. lecontei*, Swaine, on *P. ponderosa* and *P. contorta* in the Eastern portion of the State, and in the coast variety of *P. contorta* near the mouth of Siuslaw River;

33) *Ips emarginatus*, Lec., attacks the cambium of the lower and middle trunk of *P. ponderosa* and *P. contorta*; it excavates large mines often cutting through those of *Dendroctonus valens*, *D. monticolae* and *D. brevicornis* and attacks living, dying and recently dead trees, both standing and fallen;

34) *Ips* n. sp., collected from a *Pinus ponderosa* (which had been dead at least 2 years) at Hood River;

35) *I. latidens*, Lec., on *P. ponderosa* on Boundry Creek, Grant County;

36) *I. radiata*, Hopk., not uncommon in *P. contorta* and *P. ponderosa* in the Blue Mountain Region of Eastern Oregon; collected under bark of drying *P. contorta* in Whitman National Forest;

37) *I. rectus*, Lec., reported from Oregon by LECONTE;

38) *I. oregona*, Hopk., abundant in galleries in *P. ponderosa*, especially in recently felled trees, at Bend and Ashland;

39) *I. pini*, Lec., reported from Oregon by LECONTE;

40) *I. interruptus*, Eich., a single specimen taken from *Picea sitchensis* at Marshfield;

41) *I. interpunctatus*, on *Pinus contorta* in the Whitman National Forest;

42) *I. concinnus*, Mannh., this species ordinarily attacks *P. contorta* and *Picea sitchensis*; some adults were, however, taken from a fire-injured sapling of *Pseutosuga taxifolia* at Astoria; this was probably an accidental host;

43) *I. caelatus* var., on *Picea Engelmanni*, in Grant County;

44) *I. confusus*, Lec., on *Pinus*, in the extreme south part of the State;

45) *Orthotomicus ornatus*, Swaine, on *Pinus ponderosa* in the Whitman National Forest;

46) *Phloeosinus dentatus*, Say., a single example collected from *Chamaecyparis nootkatensis*, at Elk Lake;

47) *Ph. punctatus*, Lec., found doing considerable damage to *Juniperus occidentalis* in the vicinity of Bend and Prineville, in Central Oregon; galleries of this beetle were also found in *Libocedrus decurrens* on the Klamath Indian Reservation. It has been taken from its gallery

Thuya plicata, *Chamaecyparis nootkatensis* and *Ch. Lawsoniana* in the Western part of the ate; the cocoons of an unidentified hymenopterous parasite were found in the mines made the beetle in *Juniperus*;

43) *Ph. cristatus*, Lec., rare, attacks *Chamaecyparis nootkatensis*, *Abies nobilis* and *Picea selmanni*;

49) *Ph. sequoiae*, Hopk., on *Thuya plicata* and *Sequoia sempervirens* in the Southwestern rtion of Oregon;

50) *Pseudohylesinus nebulosus*, Lec., particularly or living, dying or felled individuals of *eudotsuga taxifolia*; observed in both Eastern and Western Oregon;

51) *Ps. nobilis* Swaine, on *Abies nobilis* in the Cascade Mountains;

52) *Ps. laticollis*; Swaine, found with the above species on *Abies nobilis* and also on *A. iasiocarpa*;

53) *Pseudohylesinus* n. sp., taken in the act of boring into a Lebanon Cedar (*Cedrus Li-ni*) at Corvallis;

54) *Pseudohylesinus* (an undescribed species allied to *nebulosus* Lec.) taken at kington;

55) *Ps. griseus*, Swaine, less common than *Ps. nebulosus*, but in habits, life history, etc., is very similar; found attacking *Pseudotsuga taxifolia* at Breitenbush Hot Springs in the scade Mountains;

56) *Ps. sericeus* Mannh., very similar to the last 2; bred in numbers from *Pseudotsuga ifolia* collected at Corvallis, Astoria and Detroit, Oregon;

57) *Ps. sericeus* var., bored from *Pseudotsuga taxifolia* at Corvallis.

58) *Pityoktaines jasperi* Swaine; two specimens on *Abies grandis* and *A. lasiocarpa*, near mpter;

59) *Procryphalus aceris*, Hopk., on *Acer macrophyllum* at Albany;

60) *Tomicus* (*Hylastes*) *nigrinus* Mannh., on *Pseudotsuga taxifolia* at Corvallis, Ranier, storia and Svensen;

61) *Pityogenes carunculatus* Lec., found attacking living, dying and felled yellow pine *Pinus ponderosa*) at Bend;

62) *Pityophthorus pubipennis*, Lec., abundant on *Fraxinus oregona* and *Quercus Gerryana* the Western Valleys;

63) *P. punctipennis*, occasionally met with in *Picea sitchensis* and *Pinus contorta*;

64) *P. confinus* Lec.; according to SWAINE, this species is found in Washington and Ca-rnia, so it undoubtedly occurs in Oregon, but the writer has never collected it there;

65) *P. contortus*, Swaine; bred from pine cones collected at West Port, Oregon;

66) *P. nitidulus*, Mannh., a widely distributed species found in dying *Pinus Picea* and *eudotsuga*, throughout the State;

67) *Pityophthorus* n. sp., a species similar to *nitidulus*, collected many times from *Abies ndis* in the valleys and from *A. nobilis* in the Cascades;

68) *Trypodendron* (*Xyloterus*) *lineatus*, Oliver, from Seaside;

69) *Tryp.* (*Xyl.*) *politus*, Say, a single specimen bearing label "Huntingdon Oregon", obably wrongly labelled;

70) *Try. ruficarsis*, Kirby, on *Pinus Contorta* near Sumpter.

71) *Trypodendron* n. sp., near *rufitarsis*, collected on living *Pseudotsuga taxifolia* at Breitenbush Hot Springs;

72) *Xyleborus dispar* Fabr., in orchard trees, at Portland, Salem, Corvallis, Oregon City d Eugene;

73) *Xyleborus xylographus*, Say on *Quercus Gerryana* and *Pseudotsuga taxifolia* at Cor-llis;

74) *Platypus wilsoni*, Swaine, found on *Abies grandis* at Corvallis; *A. nobilis*, Elk ke; *Tsuga heterophylla*, Detroit; *Pseudotsuga taxifolia*, Corvallis and Ranier.

115 – ***Sphinx convolvuli* in England in the Autumn of 1917** (1). — CLARKE, W. ... in *The Naturalist*, No. 731, p. 398. London, December, 1917.

In the autumn of 1917 an immigration of the Convolvulus Hawk Moth was observed in the Scarborough district. The author saw specimens of this moth captured at Scarborough on August 22nd. and September 9th, 10th. and 12th., together with two others obtained in September, the exact date being unknown. Another specimen was captured at Scalby on August 31st.

116 – **On the Parthenogenetic Reproduction of *Otiorryhncus sulcatus*, a Coleopteron Injurious to the Vine, in France.** — FEYTAUD, J., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 22, pp. 767-769. Paris, 1917.

Up to the present the vine weevil (*Otiorrhyncus sulcatus* Fabr.), well known in France for the damage it does to the vine, was considered as having normal sexual reproduction.

The serious attacks made by it in recent years in the Saint-Pierre d'Oléron vineyard (2) gave the author, during the years 1914 to 1916, an opportunity of studying many specimens of this weevil both under natural conditions and in captivity. Among thousands of individuals examined, some of which showed the external characteristics considered proper to the male, the author found none but females.

In May 1917, 50 weevils, collected at the beginning of the season, laid fertilised eggs which gave live larvae, although all the weevils were found to be female.

These observations show the coleopteron in question, like *O. ligustici* Bohem., *O. cribricollis* Gyll., and *A. ligustici* Linn., to be reproduced generally, if not constantly, by parthenogenesis, thereby adding a fourth species to the three parthenogenetic ones already known. This species is the most common and most harmful of those found in France.

The fact is of great importance from a practical point of view. Since all, or nearly all, the individuals are females, and each lays more than 100 eggs, the annual production is very large in favourable environmental conditions, and the centres attacked spread very rapidly if energetic measures to destroy the pest are not taken.

It is probable that males do exist, but they are doubtless very rare, appearing only sporadically in certain generations.

The parthenogenesis of *O. sulcatus* and its three above mentioned allied species, must be placed, provisionally at least, in the type of irregular parthenogenetic cycle, although the existence of males still remains to be definitely proved.

117 – **A Note on Resistance to Black Scale in Cotton.** — HARLAND, S. C., in *West Indian Bulletin*, Vol. XVI, No. 3, pp. 253-256. Bridgetown, Barbados, 1917.

Certain varieties of cotton plant are immune to attack from black scale (*Saissetia nigra* Nietn.). In 1914 many Seredo cottons were introduced into St. Vincent, and showed great differences in their susceptibility ...

(1) See also *R. Dec.* 1917, No. 1251. — (2) See on this subject *B. Nov.*, 1917, No. 1085. (*Ed.*)

ck scale. Two types, remarkable for their resistance, were isolated and ivated, and, in the following year still showed the same immunity. e of them, carefully studied for three generations, never showed any trace lack scale though the other varieties were badly attacked. The immunity ertain types of cotton is, then, a fixed and transmissible character.

Hybridisation experiments were carried out with the Seredo, a naturally une variety, and the Sea Island variety, which is very susceptible. hybrids were quite uniform in their morphological characters, and e almost completely immune to black scale, only a few scattered speci- is of the insect being found.

Immunity, therefore, behaves as a partial dominant.

MEANS OF PREVENTION AND CONTROL

- **Natural Enemies of *Chrysomphalus dictyospermi*, a Coccid Injurious to Citrus** (1). — MALENOTTI, ETTORE, in *Redia*, Vol. XIII, Pt. 1, pp. 17-53, pl. 1-2. Florence, 1917.

The following are mentioned as natural enemies of the coccid *Chrysomphalus dictyospermi* Morg.:

1) a fungus, *Cladosporium* sp., often found in Calabria and Sicily, de and outside the insect; its importance as a parasite of the coccid has yet been shown;

2) the mite *Allothrombidium gymnoptorum*, preying actively on the ect in question, on *Diaspis pentagona* Targ. and other *Diaspinae*; it of no agricultural importance;

3) the native predatory coleoptera: *a*) *Chilocorus bipustulatus*, L., ily seen on trees attacked by *D. pentagona*, *Aspidiotus hederae* Vall., *issetia oleae* Bern., and which may also be found on trees attacked by *r. dictyospermi*; it is prevented from spreading by the endophagous hymoptera *Tetrastichus epilachnae* (Giard.) and *Homalotylus flaminius* dm.); this coleopteron, which has never seriously impeded the developnt of *D. pentagona* or *Chr. dictyospermi* in Italy, is of great importance Spain where, in the province of Valencia, a decrease of this last coccid he orange-groves, corresponds to a great increase of the coleopteron; *Exochomus 4-pustulatus* L., which, like the previous one, has three generas each year; *c*) *Cybocephalus rupifrons* Reitter;

4) the following imported predatory coleoptera: *a*) *Rhizobius lonae* Blaied; *b*) *Rhiz. ventralis*; c) *Orcus calibaeus*; these have not yet n proved to be of practical importance in the destruction of *Chrys. yospermi*.

Then follows a description of 7 chalcid hymenoptera, three of which ng to the sub-family *Eulophynae* and are endophagous:

1) *Aspidiotiphagus citrinus* (Craw.) How., which attacks many ies of Diaspina, among which are *Aonidia lauri* (Bouché), *Aonidiella ntia* var *citrina* (Coq.), *A. perniciosa* (Comst.), *Aulacaspis pentagona*

(1) See also *B.* April, 1911, No. 1312; *B.* April, 1915, No. 451; *B.* October, 1915, No. 1102; ly, 1916, No. 827; *R.* August, 1916, No. 948; *R.* October, 1916, No. 1140; *R.* Nov. 1916, 1245; *R.* January, 1917, No. 110. (*Ed.*).

(Targ.), *A. rosae* (Bouché), *Aspidiotus hederae*, *A. betulae* Baer., *A. destructor* Sign., *Chrysomphalus ficus* Ashm., *Chrys. dictyospermi*. *Hemichionaspis aspidistrae* (Sign), *H. minor* (Mask.), *Lepidosaphes beckii* (Newm.), *Leucaspis signoreti* Targ., etc., but, in Italy at least, the host in which it is most frequently found is *A. hederae*; one of its varieties — *Aspidiotiphagus citrinus* var. *agilior* Berl. — breeds in abundance from *Chionospis pinnymi* Comst.; the value of this variety in the control of Diaspine is not to be despised; in limited areas it sometimes succeeds in checking *A. hederae*, as was the case in the olive orchards of Liguria; but its action is too uncertain for it to be considered always as a means of controlling *A. hederae*; it proved no less efficacious against *A. destructor* on coconuts in the island of Tahiti; *A. citrinus* has been found in *Chrys. dictyospermi* of America since 1904; recently the author found it in the same insect living on *Sansevieria arborescens* in the greenhouses in the Italian Colonial Agricultural Institute at Florence; later, from the coccid of the same *Sansevieria* plant, the author obtained a new *Prospaltella* (*Pr. fasciata*); the percentage (97 %) of *Chrys. dictyospermi* attacked, attributed entirely to *A. citrinus*, must be considered as representing the total action of the two chalcids; it has so far been impossible to determine how much of this total is due to each of the two species; it appears that the proportion of female *Chrys. dictyospermi* attacked by *Pr. fasciata* is fairly high;

2) *A. lounsburyi* Berl. and Paol., does not attack *Chrys. dictyospermi* only; the author also found it in large numbers in *Fiorinia fioriniae* Targ. on an undetermined plant from Madeira, and at the end of June, 1910 it was found in fairly large numbers on *Diaspis boisduvali* Sign. living on leaves of *Vanilla aromatica* and also, a few days later, on *Hemichionaspis aspidistrae* on a fern of the genus *Nephrolepis*, both in the greenhouses of the Torrigiani garden, at Florence; as regards the value of this chalcid in the control of *Chrys. dictyospermi*, not only were 50% of the specimens of this scale sent by LOUNSBURY from S. Africa attacked, but also scales of other species sent to Florence from Madeira seemed to be attacked by it in large proportion; for this reason it is being distributed by the Royal Station of Agricultural Entomology of Florence.

3) *Prospaltella fasciata* Malen., obtained, as already stated, from *Chrys. dictyospermi* on *Sansevieria arborescens* in the greenhouses of the Italian Colonial Agricultural Institute of Florence with *Aspidiotiphagus citrinus*.

The other four chalcids described belong to the ectophagous species:

1) *Aphelinus chrysomphali* Mercet (sub-family *Eulophynae*), found by MERCET on *Chrys. dictyospermi* from Spain; the description given by the author is based on two females obtained from *Chrys. dictyospermi* on citrus material sent for study from Spain (Alicante and Palma de Mallorca) and on 70 other females from *Aonidiella aurantii* (Mask.) from gardens in Greece; whereas, according to MERCET this *Aphelinus* is of little practical importance in the control of *Chrys. dictyospermi*, it is very efficacious against *Aon. aurantii* living on lemons and cedrates in Greece (Calamata, Corfu, some islands of the Aegean Sea); in this country it has been noticed that the smell of unburied manure placed under the cedrate tree keeps *Aphelinus*

way, thus allowing *Aonidiella* to multiply ; dust which covers the foliage f the trees planted along a road has the same effect.

2) *A. silvestrii* De Greg., the author's description is based on the xamination of one female only, obtained near the Royal Station of Agricul- ıral Entomology at Florence from *Chrys. dictyospermi* on orange leaves sent om Palermo by Marquis DE GREGORIO, whose favourable opinion on ıe practical value of this *Aphelinus* for destroying *Chrys. dictyospermi* is ot borne out by observations made at Florence ; from many hundreds f the coccid sent by Marquis DE GREGORIO, only one specimen of *Aphe- inus* was obtained, and from material, sent by Prof. T. DE STEFANI, also om Palermo, and including fresh leaves of orange, maple and ivy, only wo female chalcids were obtained, both from *Chrys. dictyospermi* from aple leaves.

3) *Signiphora merceti* Malen. (sub. family *Encyrtinae*) ; two females btained at Florence on *Chrys. dictyospermi* from Spain, and one female btained from *Hemiberlesià camelliae* on Robinia from Pietrasanta (Lucca) ; cording to the author this chalcid is not of great importance as a natural nemy of *Chrys. dictyospermi*.

4) *Aphicus hesperidum* Mercet (sub-family *Encyrtinae*) ; two male ecimens obtained from *Chrys. dictyospermi* from Spain ; there is little ope that this chalcid will play a great part in the control of *Chrys. dictyo- permi*.

10 – ***Phora fasciata*, a Dipterous Parasite of the Coleopteron *Coccinella septempunctata*, in France.** — DU BUISSON, H., in *Bulletin de la Société Entomologique de France*, No. 15, pp. 249-250. Paris, 1917.

In July 1912, the author collected in the department of Allier pupae *Coccinella septempunctata* L., fixed as usual on the upper part of the vine aves. After having kept them in a small box for a long time, he noticed hat one was deformed, and that, near the shreds of leaves near it, were nall pupae from which minute diptera had emerged.

In June, 1917, the author again collected in the same department upae of *C. septempunctata* fixed, well in evidence, on potato leaves, and ut aside 37 specimens in perfect condition. Of these, 33 emerged norm- ly towards July 12th., but the 4 others were deformed, and near them, the leaf on which they lay, were again dipterons pupae. These were aced for observation in a tube and the perfect insect emerged after July 2th.

DR. J. VILLENEUVE, who examined the dipteron, identified it as *Phora sciata* Fallén, adding that RONDANI (*Atti Soc. ital. Sc. nat. Milano*, II 860], p. 165) had already published a note describing this species as a rasite of the pupae of *C. septempunctata*.

10 – ***Sycosoter lavagnei* n. g. and n. sp., a Hymenopterous Parasite of the Coleopteron *Hipobarus ficus*, Injurious to the Fig Tree, in France.** — PICARD, FRANÇOIS and LICHTENSTEIN, JEAN L., in *Bulletin de la Société Entomologique de France*, No. 16, pp. 284-287, figs. 1-3. Paris, 1917.

The breeding-out of the scolytid *Hypoborus ficus* Erichs, from the bran- es of the fig-tree, at Montpellier, gave a braconid parasite described here

as a genus and species new to science under the name of *Sycosoter lavagnei*.

This insect is an external parasite of the larva of *Hyp. ficus*. The egg is placed on the host through the bark of the fig tree. The larva spins a cocoon in the gallery of the scolytid for pupation.' It appears that *Syc. lavagnei* has as many generations as *Hyp. ficus*. The spring females of the hymenopteron are almost all winged ; those of the autumn are chiefly apterous. 'Winged males seem rarer than apterous ones, even in spring.

121 – ***Phytoecia cylindrica*, a Coleopteron Injurious to Carrots, in Sweden.**

KEMNER, N. A., in *Meddelande No. 139 fran Centralanstalten for Försöksväsendet i Jordbruksomr. del, Entomologiska Avdelningen*, No. 26, pp. 1-8, fig. 1-8. Stockholm.

In the autumn of 1915, the cerambycid *Phytoecia cylindric* L. ("Stjälkbocken") was reported to be damaging seed carrots near the Stockholm Agricultural Experiment Station.

The larvae of the insect, at a certain distance above the soil, enter the stalk and bore within it long galleries down to the roots, thus preventing the normal development of the plant. The insect influences not only the quantity of seed produced, but also the quality. In the case in question the percentage of seeds capable of germinating fell as low as 30.

This insect is found in the north of Sweden, as far as Stockholm, and in Västmanland. It is also fairly common in Norway and Finland.

122 - ***Rhagoletis pomonella*, the Apple Maggot, or Railroad Worm, an Injurious Dipteron Recorded for the First Time in British Columbia, Canada** (1).

TREHERNE, R. C., in *The Canadian Entomologist*, Vol. XLIX, No. 10, pp. [illegible] London, 1917.

Two adult flies of *Rhagoletis pomonella* Walsh (fam. *Trypetidae*) were taken by the writer near Penticton (British Columbia), on July 16, 1917. The fact is interesting, for this is practically the first time this insect, which attacks apples, has been recorded in the province of British Columbia, and it is practically the first time that it has been mentioned as occurring on the Pacific Coast of North America.

The flies were taken on the Red Astrachan variety of apple, but examination of its fruit and those of other early varieties in the vicinity on July 26th, and again in August, revealed no definite sign of larval injury. Many early varieties of apple had been picked and shipped at the time of the second examination. Consequently, this fact, coupled with the lateness of the season, which was towards the end of the flight period of the adults, probably accounts for the paucity of material.

As regards the distribution of this species of fly on the Pacific coast, specimens were collected by O. T. BARON in the southern part of California and described by SNOW in 1894 as *Rhagoletis zephyria* n. sp. R. W. DOANE in 1908, and J. M. ALDRICH in 1909, stated that *R. Zephyria* is a synonym of *R. pomonella*. Since the record of 1894, apparently this insect has not been observed again in California.

(1) See also *B.* January 1915, No. 127 and *B.* December 1915, No. 1756 (E

According to information furnished to the writer by ALDRICH, the insect as been recorded from the eastern slope of Colorado (Colorado Springs, ort Collis).

No information is available that the species exists in the State of Oregon, ut A. L. MELANDER states that it has been recorded as destructive along the astern border of the State of Washington. He remarks, however, that ere is no positive evidence of its occurrence in Washington orchards.

Consequently, the record for British Columbia is almost unique for ie Pacific Coast. Evidently the insect is not yet numerous in British olumbia, otherwise its presence would have been observed before. Even et, no definite form of larval injury has been observed, and the record, us far, exists only in the form of the capture of 2 adult flies. It is interest-g to note, however, that E. H. STRICKLAND captured a single specimen of is fly at Lethbridge (Alberta) in 1914. These as little doubt that the insect nerged from imported fruit, and as the Province of Alberta is supplied ore commonly with western fruit than with eastern, the record suggests a interesting probability.

23 - ***Stomacoccus platani* n. gen., and n. sp., A Coccid Observed on *Platanus racemosa* in California.** — FERRIS, G. F., in *The Canadian Entomologist*, Vol. XLIX, No. 11, pp. 375-378 + figs. 36-39. London, November, 1917.

This paper gives a systematic description of the new genus *Stomacoccus* nd the new species *St. platani* together with information on the biology the coccid.

The insect was found in California on leaves, branches and trunk of *latanus racemosa* (sycamore) at Pasadena, Stevens Creek (Santa Clara ounty) and near Stanford University.

24 - **Cynipidae Observed on *Castanopsis* spp. and *Quercus* spp. in America.** — BEUTENMULLER, WM., in *The Canadian Entomologist*, Vol. XLIX, No. 10, pp. 345-349. London, October, 1917.

This paper gives a systematic description of the following gall-forming ymenoptera :

1) *Andricus castanopsidis* n. sp., on flowers of western chinquapin *astanopsis sempervirens* and *C. chrysophylla*), in the following districts of alifornia : Pacific Grove (Monterey County), Truckee, Mount Tamalpais, lacer County ;

2) *A. myrtifoliae* n. sp. on flowers of *Quercus myrtifolia* at Jacksonville nd Palat Ka (Florida) ;

3) *A. gemmiformis* n. sp. on the trunk of *Q. alba* in the district of ort Lee (New Jersey), at Woodlawn (New York City), at Evanston llinois) ;

4) *A. dugesi* n. sp. at Guanajuato (Mexico) ; the gall produced by this ecies was not observed ;

5) *Biorhiza caepulaeformis* Beutenmuller, at the base of shoots of uercus *rubra* at Evanstown ;

6) *Amphibolips nigra* Beutenmuller, on branches of *Quercus* sp. at urango (Mexico) ;

7) *Dryophanta floridensis* n. sp., on the trunk of Spanish oak (*Q. gilata*) and Blue Jack (*Q. brevifolia*), at Ocala and Jacksonville (F orida).

ALFREDO RUGGERI, *gerente reponsabile*.

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The Bureau assumes no responsibility with regard to the opinions and the results of exper outlined in this *Review*.

The Editor's notes are marked (*Ed.*).